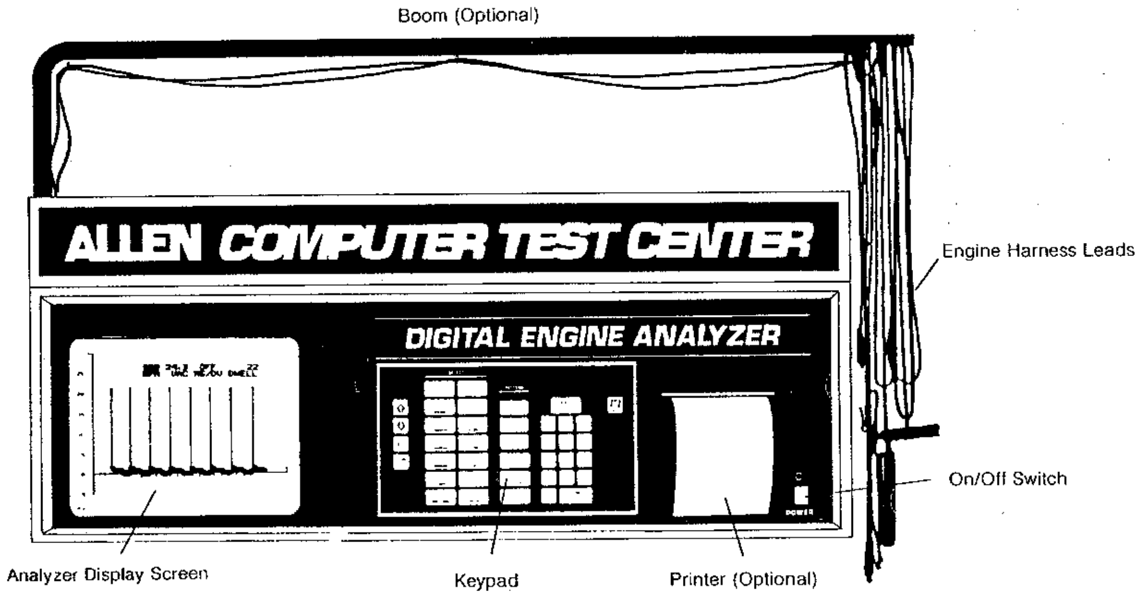
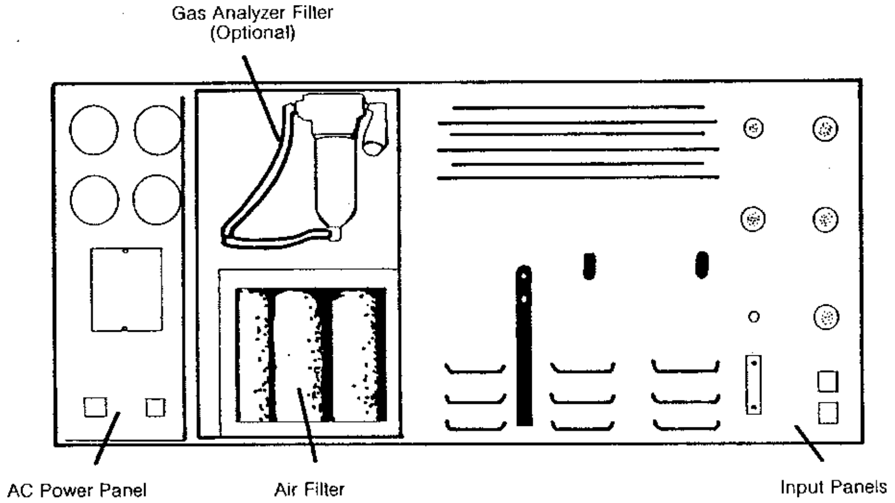
DIGITAL ENGINE ANALYZER

EZ Reference Guide

P/N 25763-1

GETTING TO KNOW YOUR DIGITAL ENGINE ANALYZER





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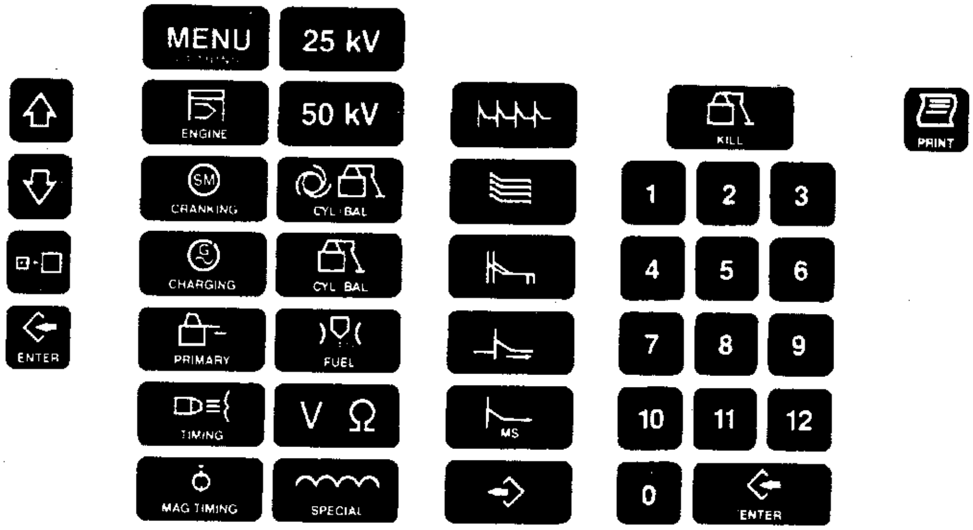
GETTING TO KNOW YOUR DIGITAL ENGINE ANALYZER
Keypad

KEYPAD

Use the keypad to select tests, control the **DEA** and change the pattern display.



Control Keys

UP ARROW	increases the Millisecond per Division value or moves the pointer (>) on the screen.
DOWN ARROW	decreases the Millisecond per Division value or moves the pointer (>) on the screen.
ALTERNATE SCREEN	switches the display to a related screen using a different display.
ENTER	records screen information in the **Digital Engine Analyzer**'s memory.

Selection Keys

These keys are always active. When you push a **Select** key, the analyzer goes directly to that screen.

MENU	displays the Special Functions screen.
ENGINE	displays the Select Engine screen.
CRANKING	disables the ignition and displays digital cranking data: RPM, volts, amps and vacuum.

CHARGING	**CHARGING**	displays charging system data (alternator diode pattern, RPM, volts, amps and vacuum).
PRIMARY	**PRIMARY**	displays ignition primary system data: Primary pattern, RPM, vacuum, volts, and dwell.
TIMING	**TIMING LIGHT**	activates the timing light and displays RPM, vacuum, and timing advance.
MAG TIMING	**MAGNETIC TIMING**	activates the magnetic timing probe and displays RPM, vacuum, degrees of timing advance, and timing probe holder offset.
25 kV	**25 KV**	displays ignition secondary patterns on the 25 kilovolt (kV) scale, digital RPM, milliseconds per division, and average firing kV.
50 kV	**50 KV**	displays ignition secondary patterns on the 50 kilovolt (kV) scale, digital RPM, milliseconds per division scale and average firing kV.
CYL BAL	**AUTOMATIC CYLINDER BALANCE**	automatically disables the ignition to each cylinder and displays the percent of RPM drop.
CYL BAL	**MANUAL CYLINDER BALANCE**	disables the cylinder(s) you select and displays the percent of RPM drop.
FUEL	**FUEL**	displays digital RPM, percent RPM change, vacuum, and (if equipped with optional gas analyzer) exhaust emissions analysis.
V Ω	**VOLT/OHM**	displays digital Direct Current (DC) voltage or resistance in ohms.
SPECIAL	**SPECIAL PROBES**	displays electrical patterns from the Red Special Test Probe, the selected sync trigger, milliseconds per division, and voltage scale.

Pattern Control Keys

These keys adjust the pattern on the screen. They are active only when a pattern is displayed on the screen. For further information about the function of each of these keys, see the next section (Analyzer Display Screen).

PRINT

PRINT has two functions:

- If your **DEA** is equipped with the optional printer, all the digital information on the screen is printed.
- If you don't have a printer, the data is "frozen" on the screen until you press the **Print** key again.

Pattern Display Methods

ANALYZER DISPLAY SCREEN

The analyzer's display screen combines the traditional oscilloscope pattern display screen with digital data.

The oscilloscope, or "scope," is a visual voltmeter that displays the rapid voltage variations.

The vertical scale represents voltage and the horizontal scale represents time.

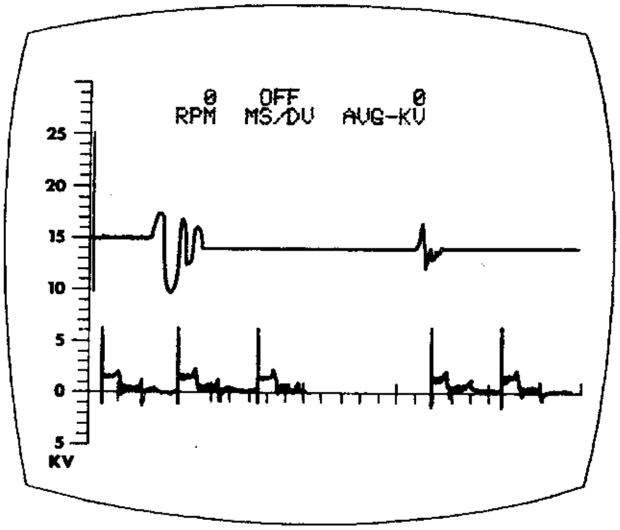
The **Digital Engine Analyzer** can either combine digital engine data with the oscilloscope patterns or display the digital data alone.

Pattern Display Methods

There are several different methods of displaying the Ignition Primary, Ignition Secondary, or Special Probes patterns. Select the method with the "PATTERN" keys.

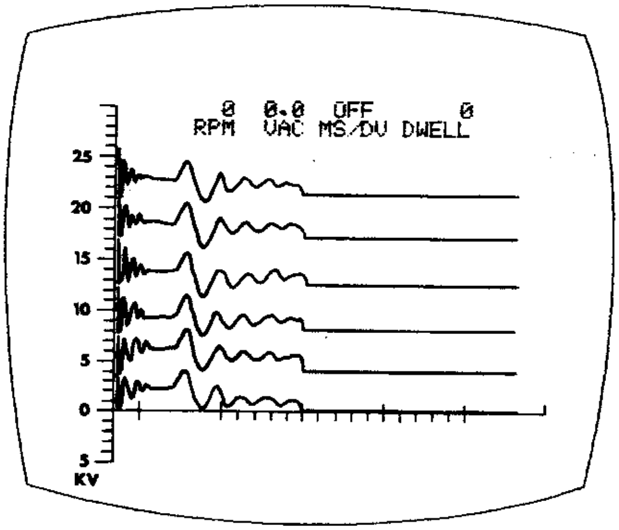
For more information about pattern display, including specific uses for each method, refer to the **Digital Engine Analyzer** Programmed Training Course (P/N 25762).

The Paraded Pattern

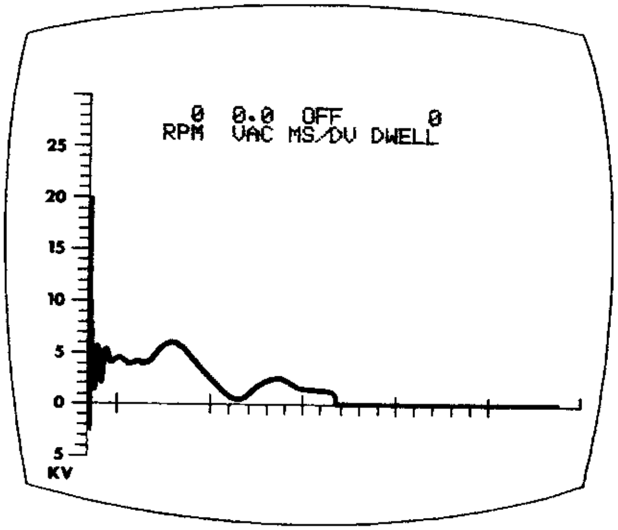


In the Paraded mode, you can pull out an individual cylinder pattern from the firing order and display it at the center of the screen. Press the cylinder's corresponding number on the keypad to pull it out.

The Stack Pattern



The Superimposed Pattern

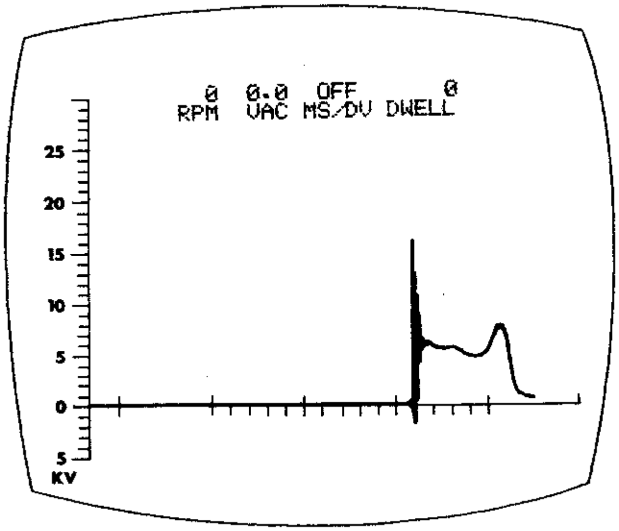


In the Superimposed mode, you can pull out an individual cylinder pattern from the firing order and display it at the center of the screen. Press the cylinder's corresponding number on the keypad to pull it out.

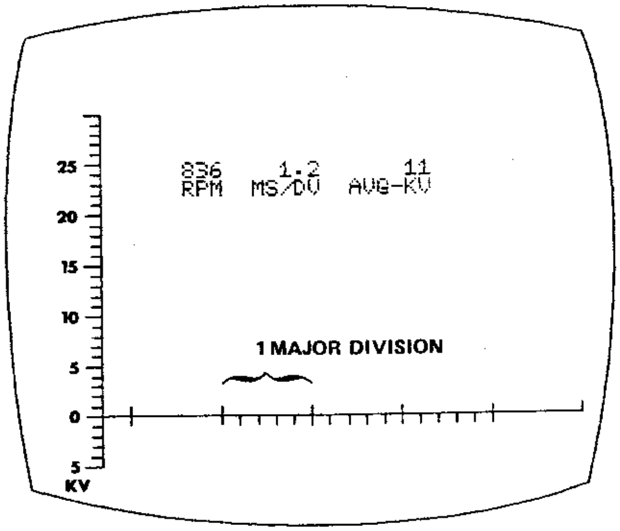
GETTING TO KNOW YOUR DIGITAL ENGINE ANALYZER
Analyzer Display Screen, Harness Hookup

Pattern Display Methods, Hookup Diagram

The Shift Pattern



Millisecond (MS) Adjust



In this mode, you can measure the time of a section of the pattern by comparing it to the scale across the bottom.

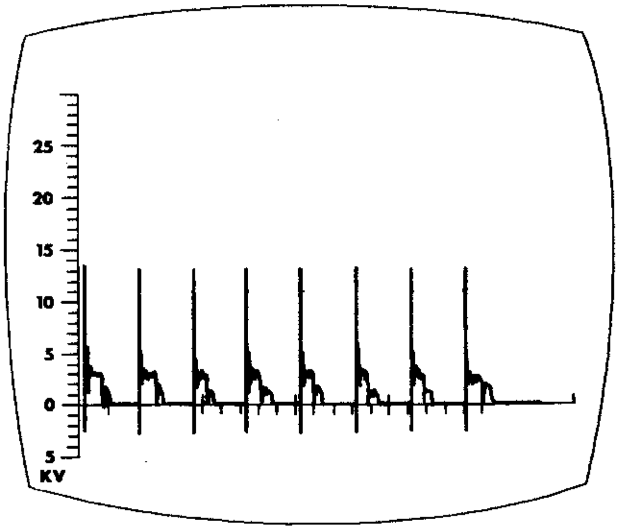
Procedure

1. Press **Stack** or **Super** while testing Ignition Secondary, Ignition Primary, or Special Test. The **MS/DV** reading at the top says **OFF**.
2. Press the MS key.
3. The **MS/DV** reading at the top indicates the number of milliseconds represented by each major division on the bottom (horizontal) scale. For example, if the **MS/DV** reading is **1.5** and the firing time covers 2 divisions, the firing time for that pattern is 3.0 milliseconds.

   1.5 ms X 2 divisions = 3.0 ms.

Pattern Only

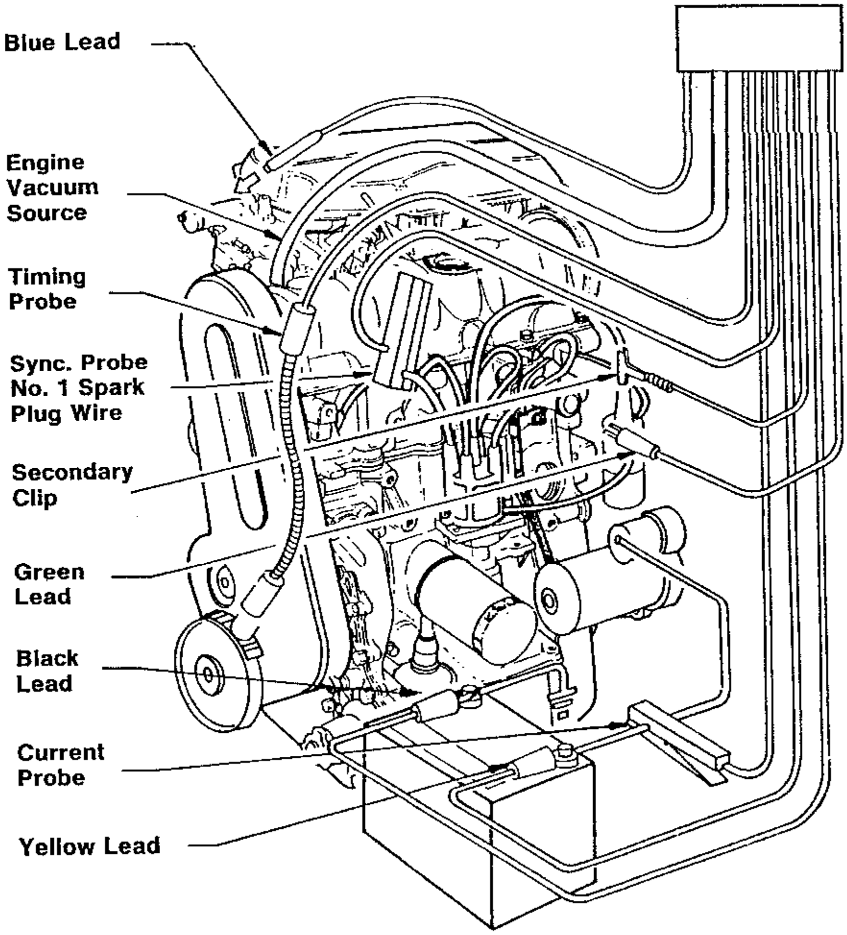
➔



This key removes the digital data from the screen and displays only the pattern.

ENGINE HARNESS HOOKUP

Connect the engine harness leads as shown in the figure below.



Insert the exhaust sample probe approximately 12" (30 cm) into the tailpipe.

BASIC PROCEDURE FOR ENGINE DIAGNOSIS
Beginning Testing

Cylinder Select, Enter Engine Options, Lead Test

BASIC PROCEDURE FOR ENGINE DIAGNOSIS

Although there are many ways to use **Digital Engine Analyzer**, the following procedure provides a quick and accurate method for an all-systems engine diagnosis. Following these instructions also enables you to build a logical step-by-step printout that can be used to market your repairs and services.

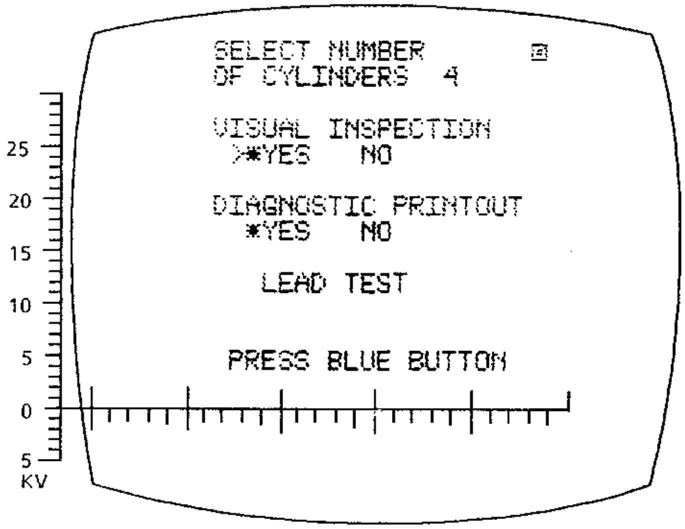
Refer to the **Digital Engine Analyzer** Programmed Training Course (P/N 25762) for additional test procedures.

1. Enter your station name in the **DEA**'s memory. You only need to do this once. The memory retains the information even if you turn OFF or unplug the analyzer. The station name will automatically appear, exactly as you enter it, at the top of each diagnostic printout.

   See **Appendix A** for a step by step procedure for name entry.

Beginning Testing

The CYLINDER SELECT screen is the first screen that appears when you turn the **Digital Engine Analyzer** on.



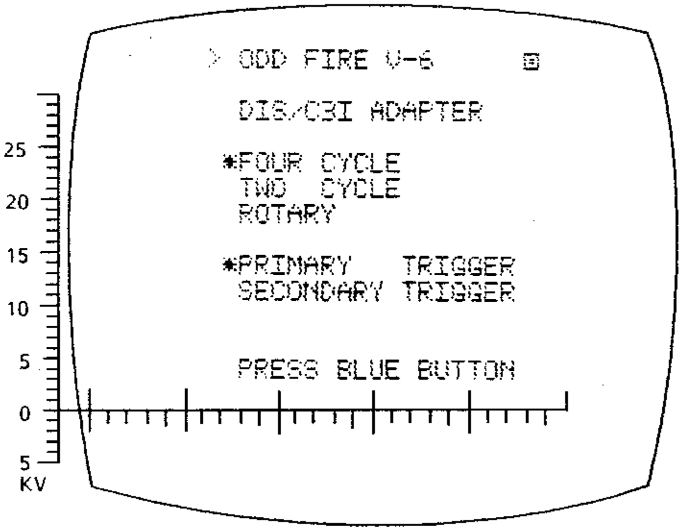
```
SELECT NUMBER
OF CYLINDERS  4

VISUAL INSPECTION
 >*YES   NO

DIAGNOSTIC PRINTOUT
  *YES   NO

   LEAD TEST

  PRESS BLUE BUTTON
```

Note that **VISUAL INSPECTION** and **DIAGNOSTIC PRINTOUT** are "preselected". These options enable you to include valuable diagnostic inspection data on the printout. For this procedure, do *not* deselect these options.

2. Enter the correct number of cylinders using the analyzer's numeric key pad.

3. Press **Alternate Screen** Key to view the **Engine Options** screen.

   For your convenience, the most commonly used items are preselected.



```
> ODD FIRE V-6      ⊡

  DIS/C3I ADAPTER

 *FOUR CYCLE
  TWO  CYCLE
  ROTARY

 *PRIMARY   TRIGGER
  SECONDARY TRIGGER


  PRESS BLUE BUTTON
```

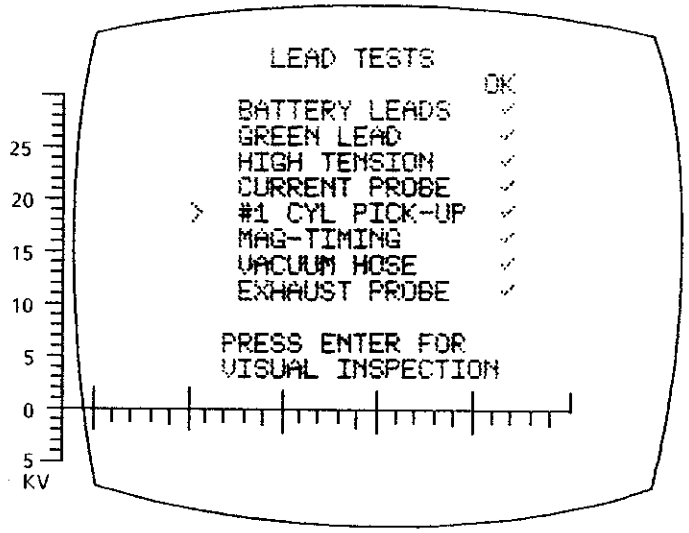
ODD FIRE V-6	Select this option only when you're testing a GM odd-fire V-6 engine (engine has a rear-mounted distributor).
DIS/C3I ADAPTER	enables the **DEA** to operate with any of Allen's Distributorless Ignition Adapters (Models 32-370, 32-470, or 32-570) designed for use on General Motors engines. **Note:** This item must be OFF if you are testing a conventional ignition system.
FOUR CYCLE (preselected)	for conventional gasoline engines.
TWO CYCLE	for 2-stroke engines.
ROTARY	enter when testing rotary (Wankel) engines used by Mazda.
PRIMARY TRIGGER (preselected)	uses the Green Lead (ignition primary) as a trigger for RPM and pattern display. The green lead must be connected to kill cylinders for the Cylinder Balance test and to disable the ignition for the Cranking test.
SECONDARY TRIGGER	uses the signal from the High Tension clamp as a trigger for RPM and pattern display.

Make sure all the information on this screen is correct, then return to the Cylinder-select screen (press the Alternate Screen key again).

4. Press the down-arrow key to move the pointer down to **LEAD TEST** and press **ENTER**. The **DEA** checks to make sure it's receiving the correct signals through the engine harness and leads.

   The screen displays a check mark to the right of each lead when it's hooked up correctly.

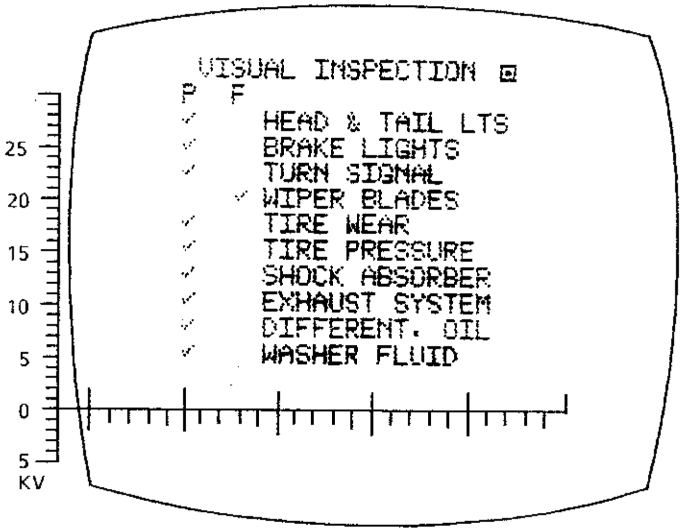
Lead Test, Visual Inspection, All-systems Testing, System Inspection Screen



```
          LEAD TESTS
                              OK
        BATTERY LEADS         ✓
        GREEN LEAD            ✓
        HIGH TENSION          ✓
        CURRENT PROBE         ✓
      > #1 CYL PICK-UP        ✓
        MAG-TIMING            ✓
        VACUUM HOSE           ✓
        EXHAUST PROBE         ✓

       PRESS ENTER FOR
       VISUAL INSPECTION
```

Visual Inspection

5. Press the **ENTER** key to advance to the visual inspection screen.



```
     VISUAL INSPECTION ▣
    P  F
    ✓     HEAD & TAIL LTS
    ✓     BRAKE LIGHTS
    ✓     TURN SIGNAL
       ✓  WIPER BLADES
    ✓     TIRE WEAR
    ✓     TIRE PRESSURE
    ✓     SHOCK ABSORBER
    ✓     EXHAUST SYSTEM
    ✓     DIFFERENT. OIL
    ✓     WASHER FLUID
```

Press the **up**- or **down-arrow** keys to move the pointer to each item on the visual inspection checklist.

Verify the condition/operation of each item and press the appropriate key on the numeric key pad to indicate Pass or Fail.

1 = Pass
2 = Fail
0 = Delete Check-mark

Press the **KILL** key to erase all the check-marks on the screen.

6. Press the **PRINT** key after you complete the visual inspection.

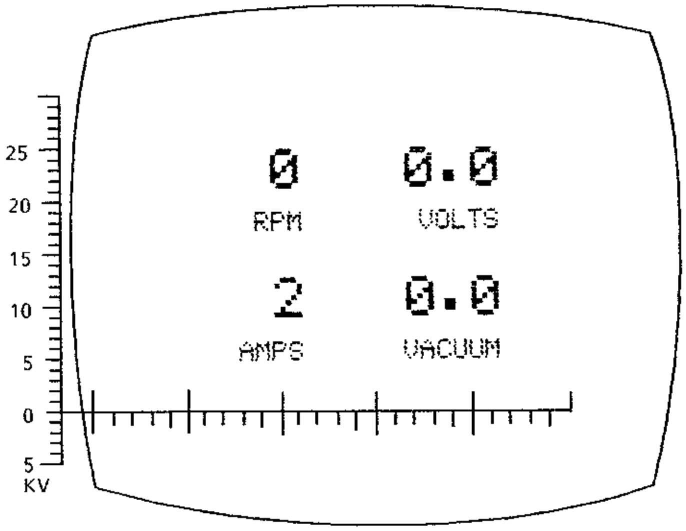
The results of the visual inspection will be included on the diagnostic printout. Only the items you check appear on the printout.

All-systems Testing

7. You are now ready to begin an All-systems Test.

   Press the **CRANKING** key.

   Use the flow chart on page 13 to diagnose the cranking system.

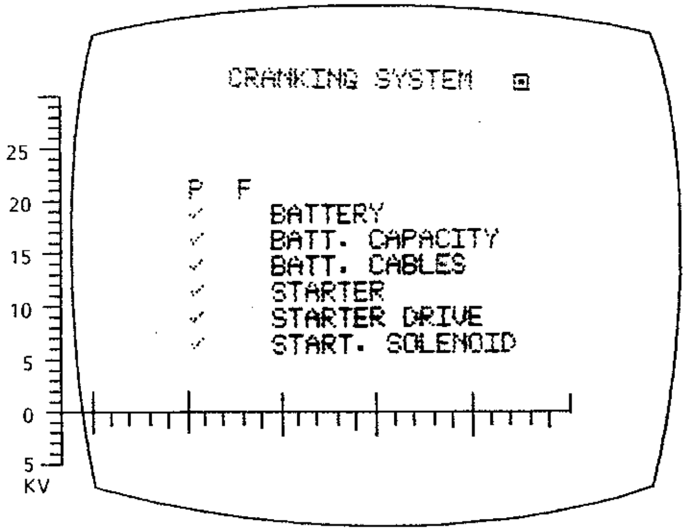


```
    0        0.0
   RPM      VOLTS

    2        0.0
   AMPS     VACUUM
```

System Inspection Screen

8. Press the **PRINT** key after completing the flow chart.

   The **Digital Engine Analyzer** adds the cranking measurements to the diagnostic printout, then displays the Cranking System Inspection screen.



```
        CRANKING SYSTEM  ⊡

P  F
✓     BATTERY
✓     BATT. CAPACITY
✓     BATT. CABLES
✓     STARTER
✓     STARTER DRIVE
✓     START. SOLENOID
```

Note: If the inspection screen does not appear after pressing the **PRINT** key, go back to the **Cylinder-select** screen and select **YES** for the Diagnostic printout option.

9. Using the arrow keys and numeric keypad (as with the *Visual* Inspection in step 5), indicate Pass or Fail for each item on the checklist.

10. Press the **PRINT** key once again to add the results of the Cranking System Inspection screen to the diagnostic printout.

Emissions Analysis, On-board Computer Diagnostics, Printout

11. Repeat steps 7, 8, 9 and 10 for the charging, ignition primary, timing, ignition secondary, power (cylinder- balance) and fuel systems.

Emissions Analysis

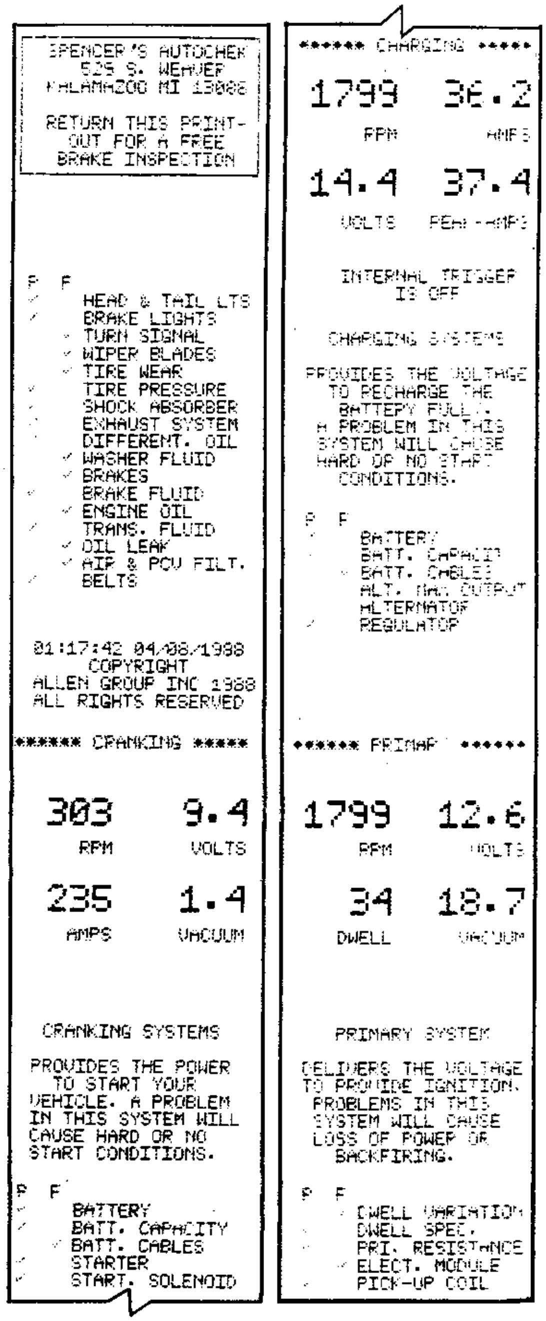
If your **DEA** is equipped with an optional gas analyzer or **4-Gas Module**, you may also wish to perform an emissions test. See the appropriate supplementary reference material for correct test procedures.

On-board Computer Diagnostics

If your analyzer is equipped with optional on-board diagnostics software, see it's accompanying reference material for correct test procedures.

Printout Sample

After you follow the procedure above, the diagnostic printout will look like this sample.



```
  SPENCER'S AUTOCHEK
    525 S. WEAVER
  KALAMAZOO MI 13008

  RETURN THIS PRINT-
   OUT FOR A FREE
  BRAKE INSPECTION



P  F
✓     HEAD & TAIL LTS
✓     BRAKE LIGHTS
   ✓  TURN SIGNAL
   ✓  WIPER BLADES
   ✓  TIRE WEAR
✓     TIRE PRESSURE
✓     SHOCK ABSORBER
✓     EXHAUST SYSTEM
✓     DIFFERENT. OIL
   ✓  WASHER FLUID
   ✓  BRAKES
✓     BRAKE FLUID
   ✓  ENGINE OIL
✓     TRANS. FLUID
   ✓  OIL LEAK
   ✓  AIR & PCV FILT.
✓     BELTS


01:17:42 04/08/1988
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****** CRANKING *****

   303      9.4
    RPM      VOLTS

   235      1.4
    AMPS     VACUUM


  CRANKING SYSTEMS

PROVIDES THE POWER
  TO START YOUR
VEHICLE. A PROBLEM
IN THIS SYSTEM WILL
CAUSE HARD OR NO
START CONDITIONS.

P  F
✓     BATTERY
✓     BATT. CAPACITY
   ✓  BATT. CABLES
✓     STARTER
✓     START. SOLENOID
```
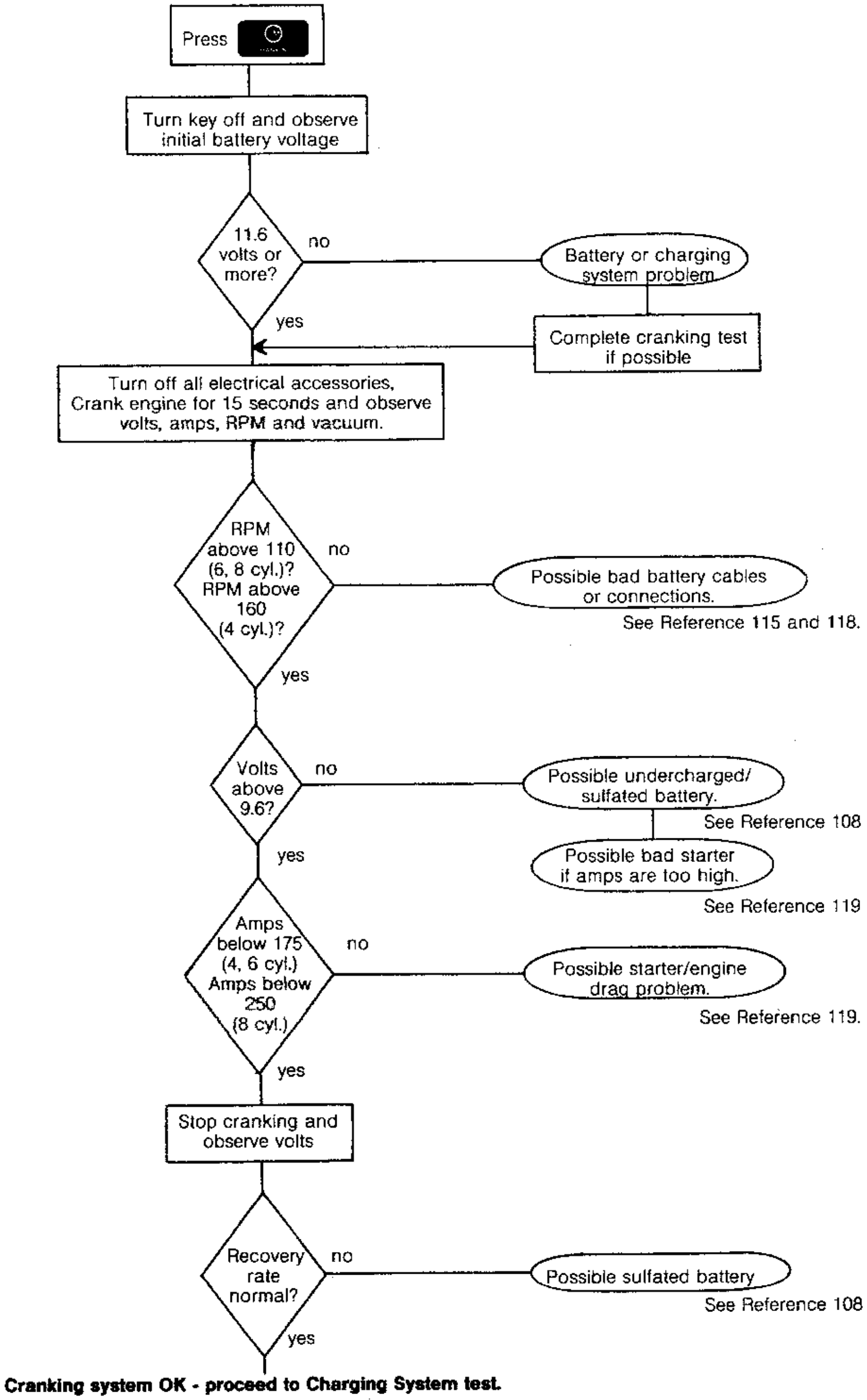

```
****** CHARGING *****

 1799    36.2
   RPM      AMPS

 14.4    37.4
   VOLTS  PEAK-AMPS

  INTERNAL TRIGGER
       IS OFF

  CHARGING SYSTEMS

PROVIDES THE VOLTAGE
  TO RECHARGE THE
   BATTERY FULLY.
 A PROBLEM IN THIS
 SYSTEM WILL CAUSE
 HARD OR NO START
   CONDITIONS.

P  F
✓     BATTERY
✓     BATT. CAPACITY
   ✓  BATT. CABLES
      ALT. MAX OUTPUT
      ALTERNATOR
✓     REGULATOR


****** PRIMARY ******

 1799    12.6
   RPM      VOLTS

   34    18.7
  DWELL     VACUUM


   PRIMARY SYSTEM

DELIVERS THE VOLTAGE
TO PROVIDE IGNITION.
 PROBLEMS IN THIS
 SYSTEM WILL CAUSE
 LOSS OF POWER OR
   BACKFIRING.

P  F
   ✓  DWELL VARIATION
✓     DWELL SPEC.
✓     PRI. RESISTANCE
   ✓  ELECT. MODULE
✓     PICK-UP COIL
```

ALL-SYSTEMS TESTING

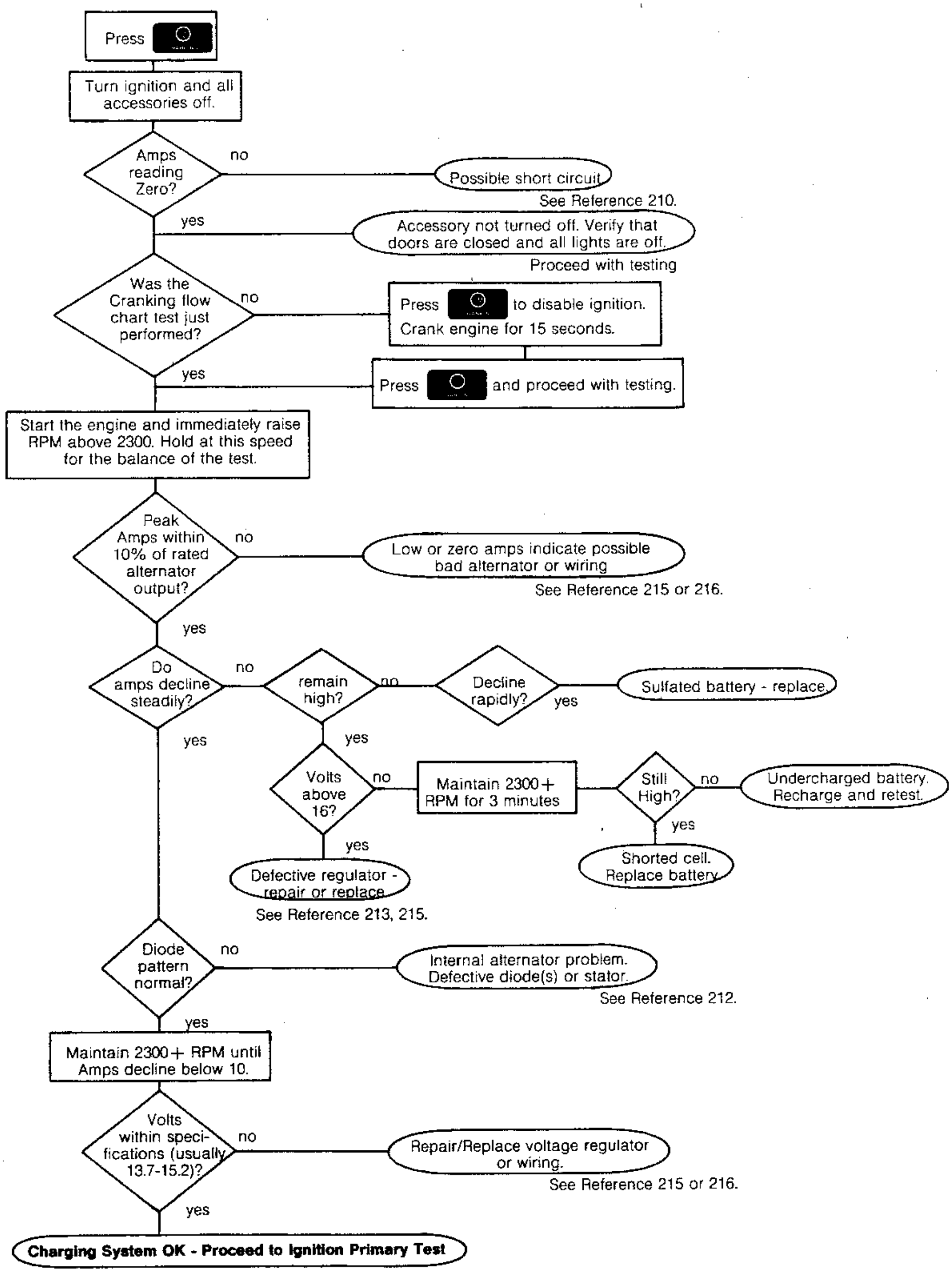
Use the following flow charts to guide you through an All-systems Test. You can also use each flow chart to diagnose the individual system.

See the **Digital Engine Analyzer** Programmed Training Course (P/N 25762) for further testing.

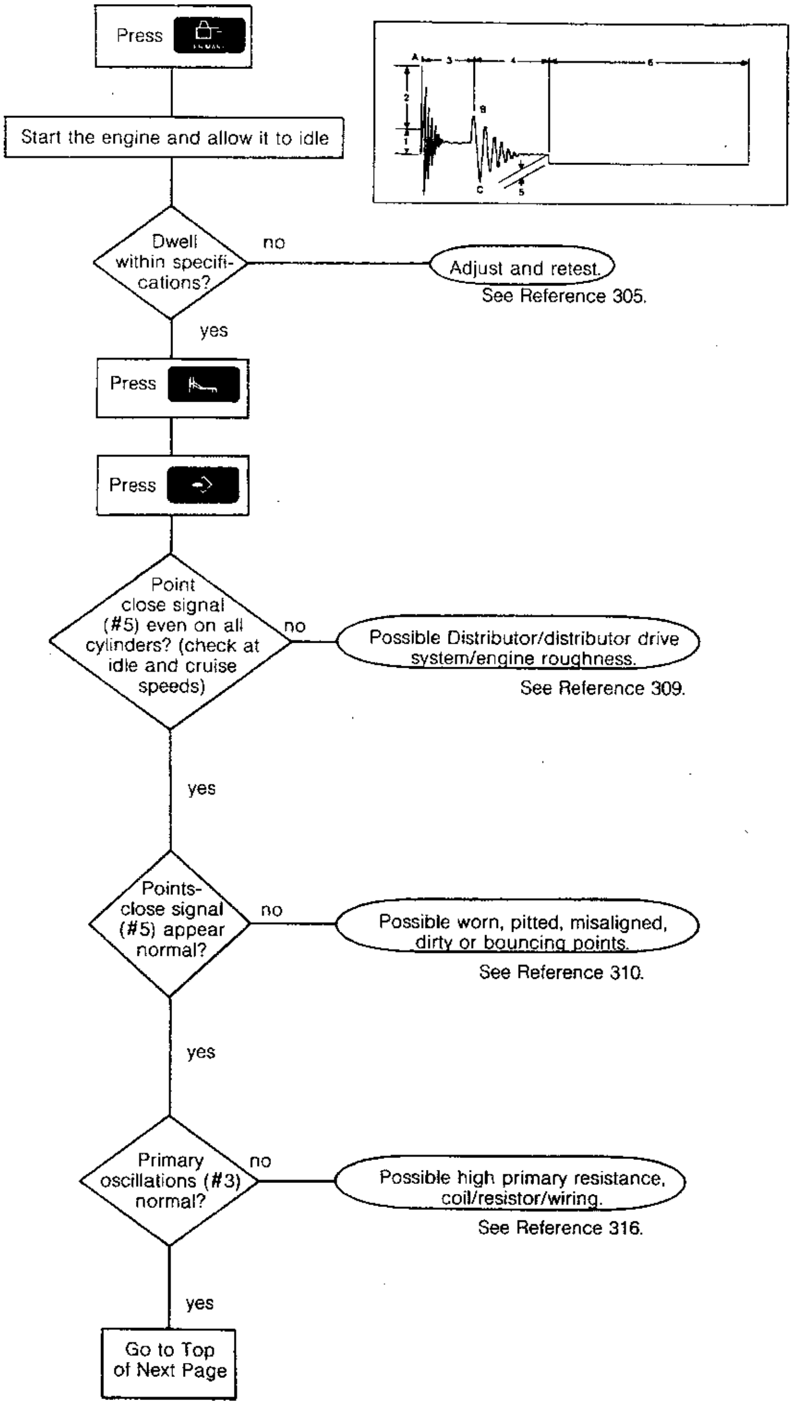
CRANKING SYSTEM


Press
Turn key off and observe initial battery voltage
11.6 volts or more?
no
Battery or charging system problem
yes
Complete cranking test if possible
Turn off all electrical accessories, Crank engine for 15 seconds and observe volts, amps, RPM and vacuum.
RPM above 110 (6, 8 cyl.)? RPM above 160 (4 cyl.)?
no
Possible bad battery cables or connections.
See Reference 115 and 118.
yes
Volts above 9.6?
no
Possible undercharged/ sulfated battery.
See Reference 108
Possible bad starter if amps are too high.
See Reference 119
yes
Amps below 175 (4, 6 cyl.) Amps below 250 (8 cyl.)
no
Possible starter/engine drag problem.
See Reference 119.
yes
Stop cranking and observe volts
Recovery rate normal?
no
Possible sulfated battery
See Reference 108
yes
Cranking system OK - proceed to Charging System test.

CHARGING SYSTEM


Press
Turn ignition and all accessories off.
Amps reading Zero?
no
Possible short circuit
See Reference 210.
yes
Accessory not turned off. Verify that doors are closed and all lights are off.
Proceed with testing
Was the Cranking flow chart test just performed?
no
Press to disable ignition.
Crank engine for 15 seconds.
yes
Press and proceed with testing.
Start the engine and immediately raise RPM above 2300. Hold at this speed for the balance of the test.
Peak Amps within 10% of rated alternator output?
no
Low or zero amps indicate possible bad alternator or wiring
See Reference 215 or 216.
yes
Do amps decline steadily?
no
remain high?
no
Decline rapidly?
yes
Sulfated battery - replace
yes
yes
Volts above 16?
no
Maintain 2300+ RPM for 3 minutes
Still High?
no
Undercharged battery. Recharge and retest.
yes
Shorted cell. Replace battery
yes
Defective regulator - repair or replace
See Reference 213, 215.
Diode pattern normal?
no
Internal alternator problem. Defective diode(s) or stator.
See Reference 212.
yes
Maintain 2300+ RPM until Amps decline below 10.
Volts within specifications (usually 13.7-15.2)?
no
Repair/Replace voltage regulator or wiring.
See Reference 215 or 216.
yes
Charging System OK - Proceed to Ignition Primary Test

IGNITION PRIMARY SYSTEM (POINTS-CONTROLLED)



Press

Start the engine and allow it to idle

Dwell within specifications?

no: Adjust and retest.
See Reference 305.

yes

Press

Press

Point close signal (#5) even on all cylinders? (check at idle and cruise speeds)

no: Possible Distributor/distributor drive system/engine roughness.
See Reference 309.

yes

Points-close signal (#5) appear normal?

no: Possible worn, pitted, misaligned, dirty or bouncing points.
See Reference 310.

yes

Primary oscillations (#3) normal?

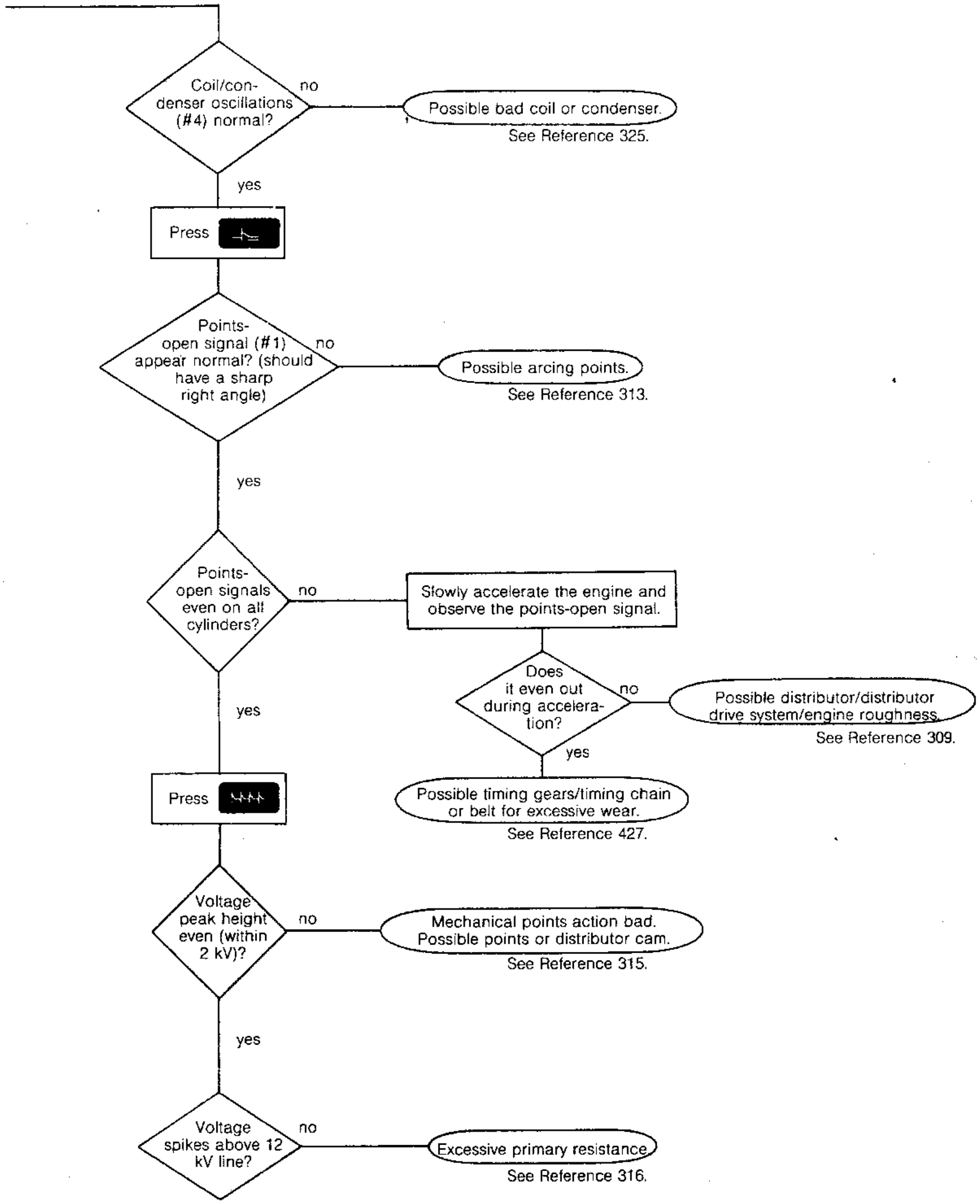
no: Possible high primary resistance, coil/resistor/wiring.
See Reference 316.

yes

Go to Top of Next Page

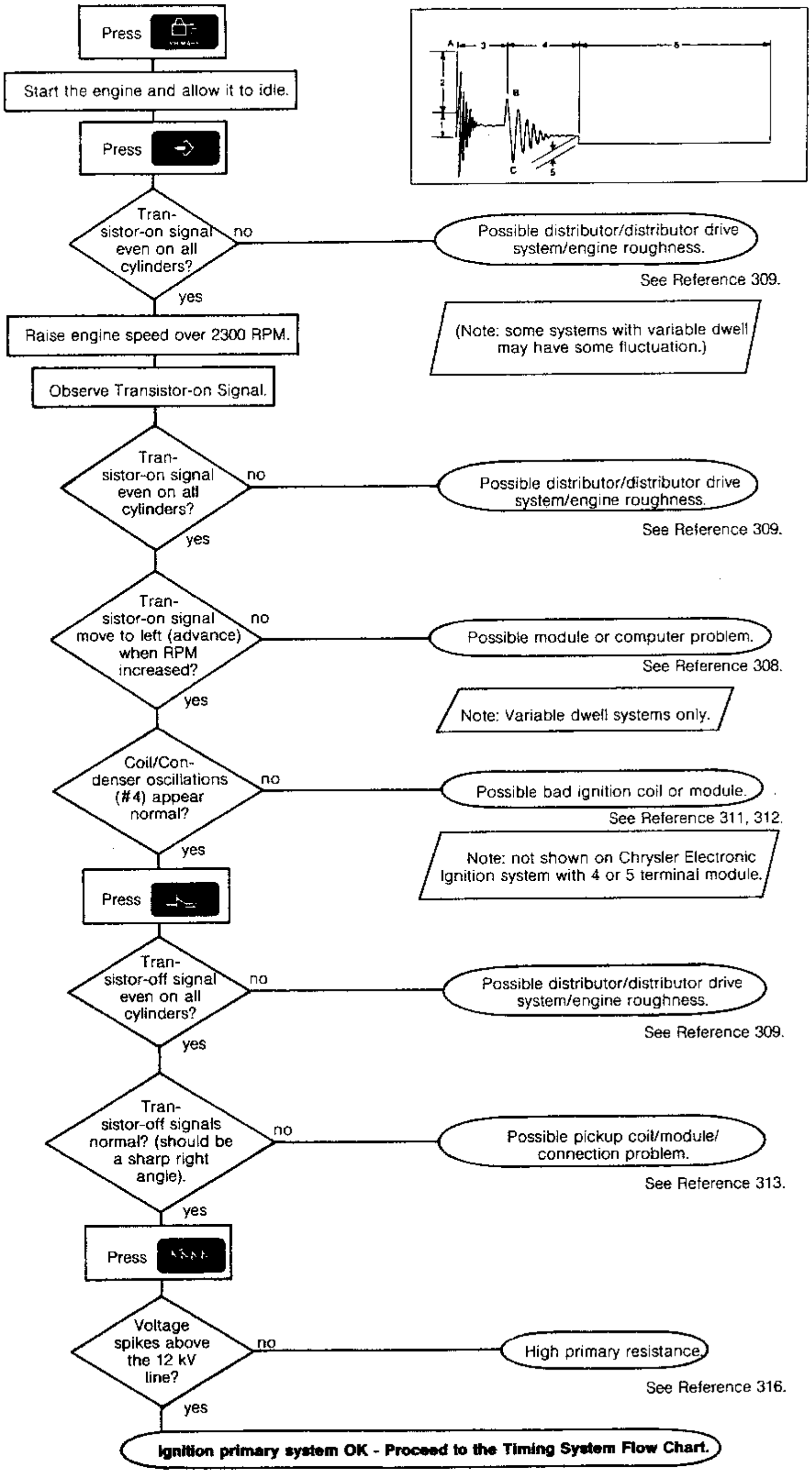
ALL-SYSTEMS TESTING
Test Flow Charts

IGNITION PRIMARY SYSTEM (POINTS-CONTROLLED)

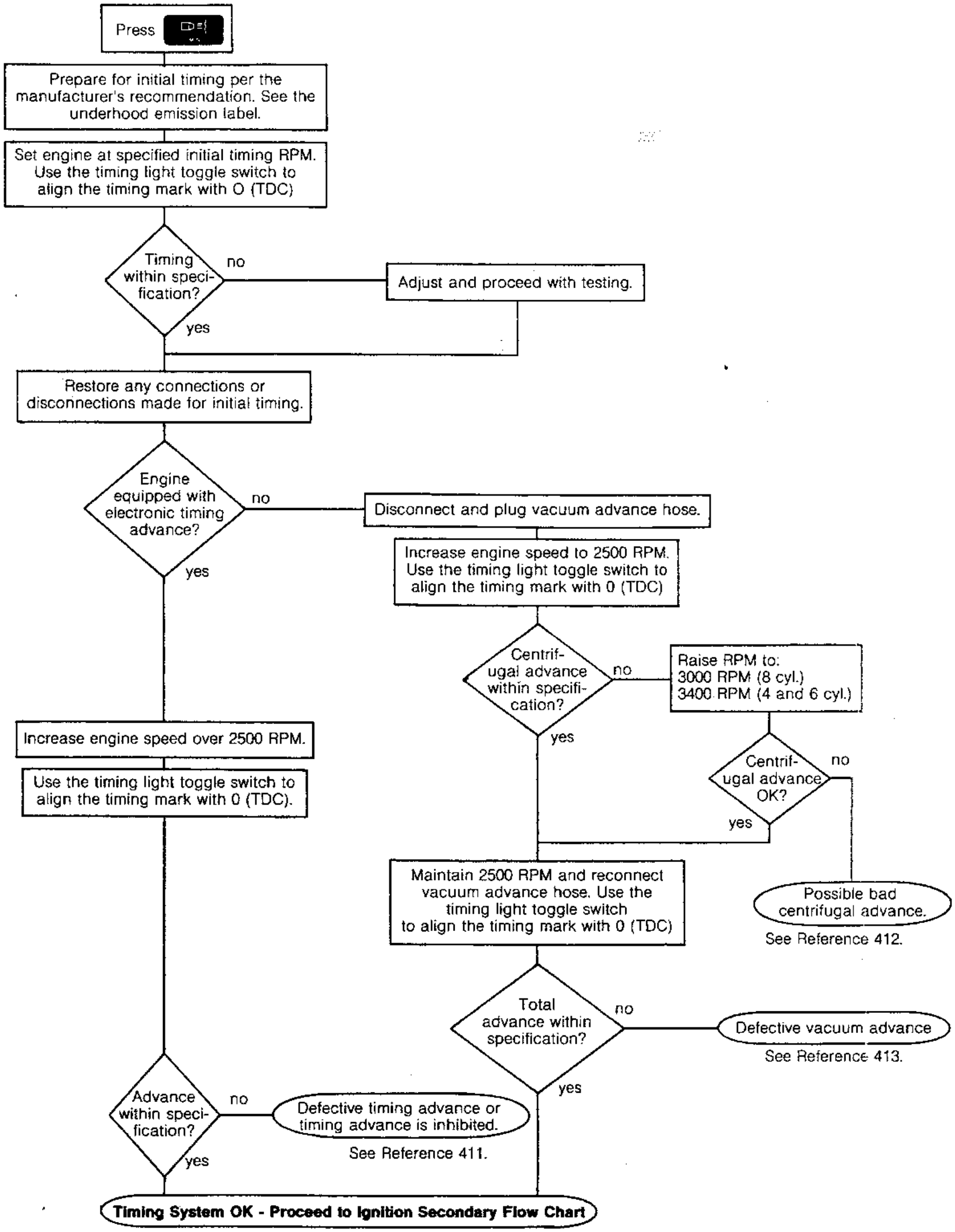

Coil/condenser oscillations (#4) normal?
no
Possible bad coil or condenser.
See Reference 325.
yes
Press
Points-open signal (#1) appear normal? (should have a sharp right angle)
no
Possible arcing points.
See Reference 313.
yes
Points-open signals even on all cylinders?
no
Slowly accelerate the engine and observe the points-open signal.
Does it even out during acceleration?
no
Possible distributor/distributor drive system/engine roughness.
See Reference 309.
yes
Possible timing gears/timing chain or belt for excessive wear.
See Reference 427.
yes
Press
Voltage peak height even (within 2 kV)?
no
Mechanical points action bad. Possible points or distributor cam.
See Reference 315.
yes
Voltage spikes above 12 kV line?
no
Excessive primary resistance
See Reference 316.

Ignition Primary system OK. Proceed to Timing Test Flow Chart.

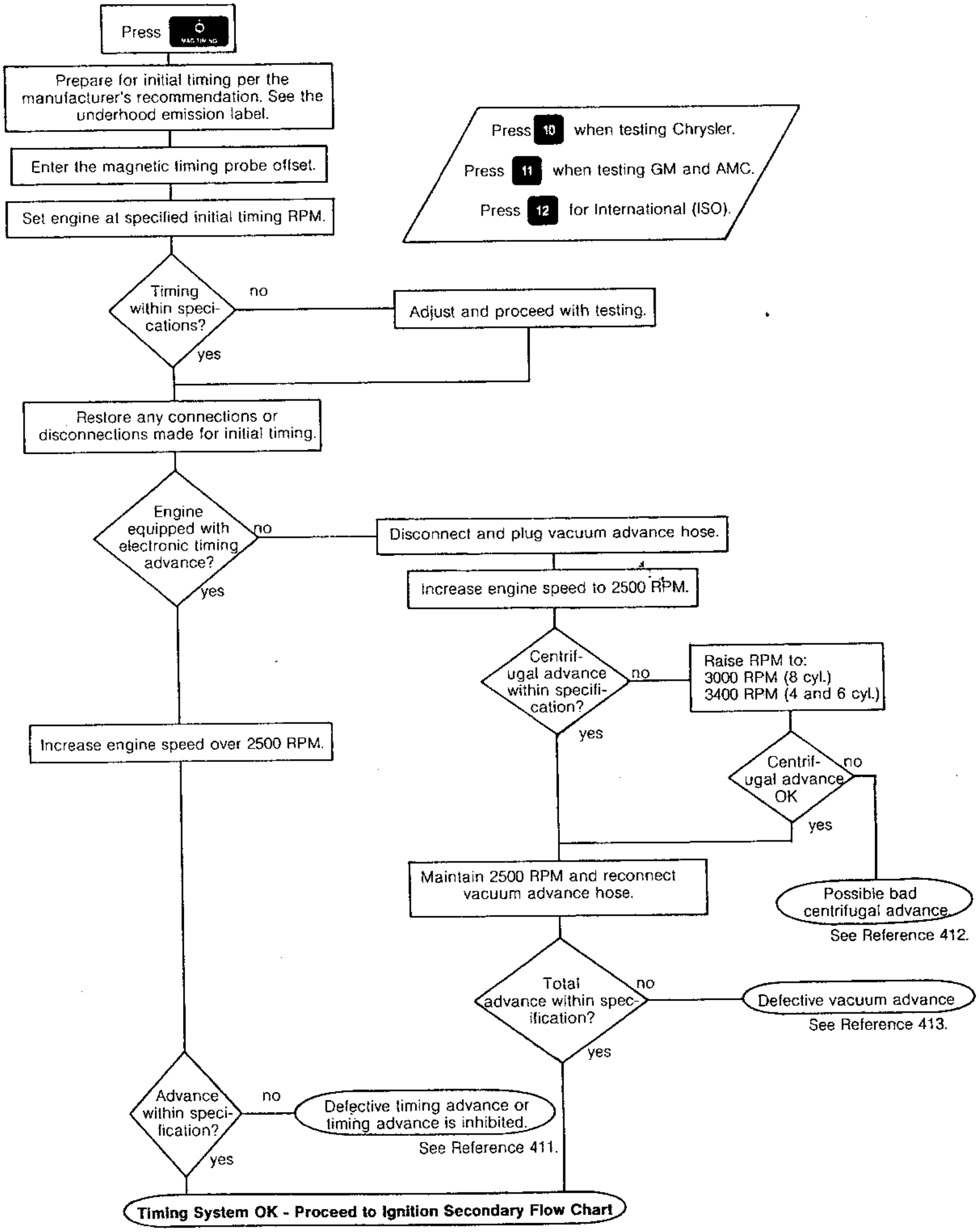
IGNITION PRIMARY SYSTEM (ELECTRONICALLY-CONTROLLED)


Press
Start the engine and allow it to idle.
Press
A
3
4
5
2
1
B
C
4
5
Tran-sistor-on signal even on all cylinders?
no
Possible distributor/distributor drive system/engine roughness.
See Reference 309.
yes
Raise engine speed over 2300 RPM.
(Note: some systems with variable dwell may have some fluctuation.)
Observe Transistor-on Signal.
Tran-sistor-on signal even on all cylinders?
no
Possible distributor/distributor drive system/engine roughness.
See Reference 309.
yes
Tran-sistor-on signal move to left (advance) when RPM increased?
no
Possible module or computer problem.
See Reference 308.
Note: Variable dwell systems only.
yes
Coil/Con-denser oscillations (#4) appear normal?
no
Possible bad ignition coil or module.
See Reference 311, 312.
Note: not shown on Chrysler Electronic Ignition system with 4 or 5 terminal module.
yes
Press
Tran-sistor-off signal even on all cylinders?
no
Possible distributor/distributor drive system/engine roughness.
See Reference 309.
yes
Tran-sistor-off signals normal? (should be a sharp right angle).
no
Possible pickup coil/module/ connection problem.
See Reference 313.
yes
Press
Voltage spikes above the 12 kV line?
no
High primary resistance.
See Reference 316.
yes
Ignition primary system OK - Proceed to the Timing System Flow Chart.

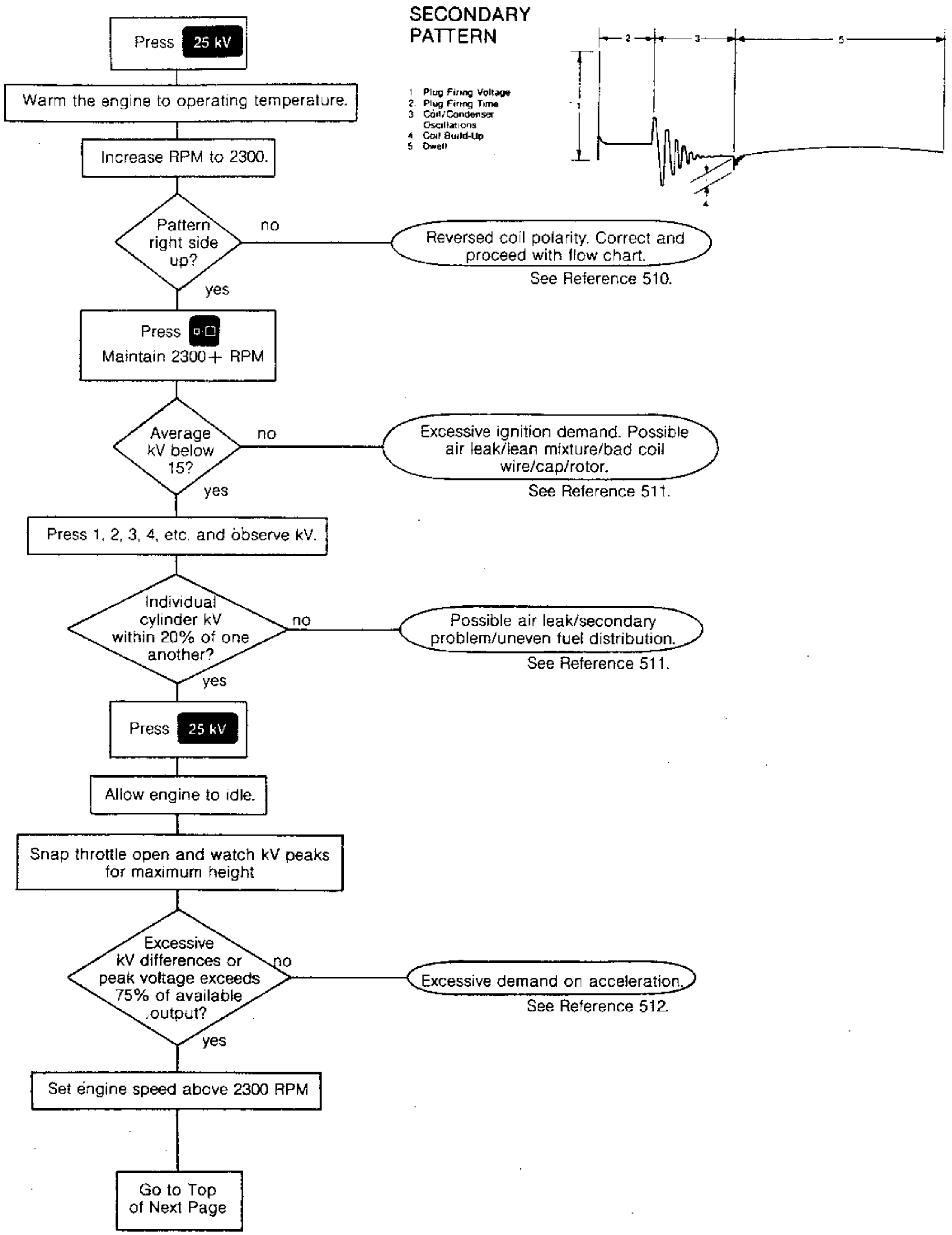
TIMING (TIMING LIGHT)


Press
Prepare for initial timing per the manufacturer's recommendation. See the underhood emission label.
Set engine at specified initial timing RPM. Use the timing light toggle switch to align the timing mark with O (TDC)
Timing within specification?
no
Adjust and proceed with testing.
yes
Restore any connections or disconnections made for initial timing.
Engine equipped with electronic timing advance?
no
Disconnect and plug vacuum advance hose.
Increase engine speed to 2500 RPM. Use the timing light toggle switch to align the timing mark with 0 (TDC)
yes
Centrifugal advance within specification?
no
Raise RPM to:
3000 RPM (8 cyl.)
3400 RPM (4 and 6 cyl.)
yes
Increase engine speed over 2500 RPM.
Use the timing light toggle switch to align the timing mark with 0 (TDC).
Centrifugal advance OK?
no
yes
Maintain 2500 RPM and reconnect vacuum advance hose. Use the timing light toggle switch to align the timing mark with 0 (TDC)
Possible bad centrifugal advance.
See Reference 412.
Total advance within specification?
no
Defective vacuum advance
See Reference 413.
yes
Advance within specification?
no
Defective timing advance or timing advance is inhibited.
See Reference 411.
yes
Timing System OK - Proceed to Ignition Secondary Flow Chart

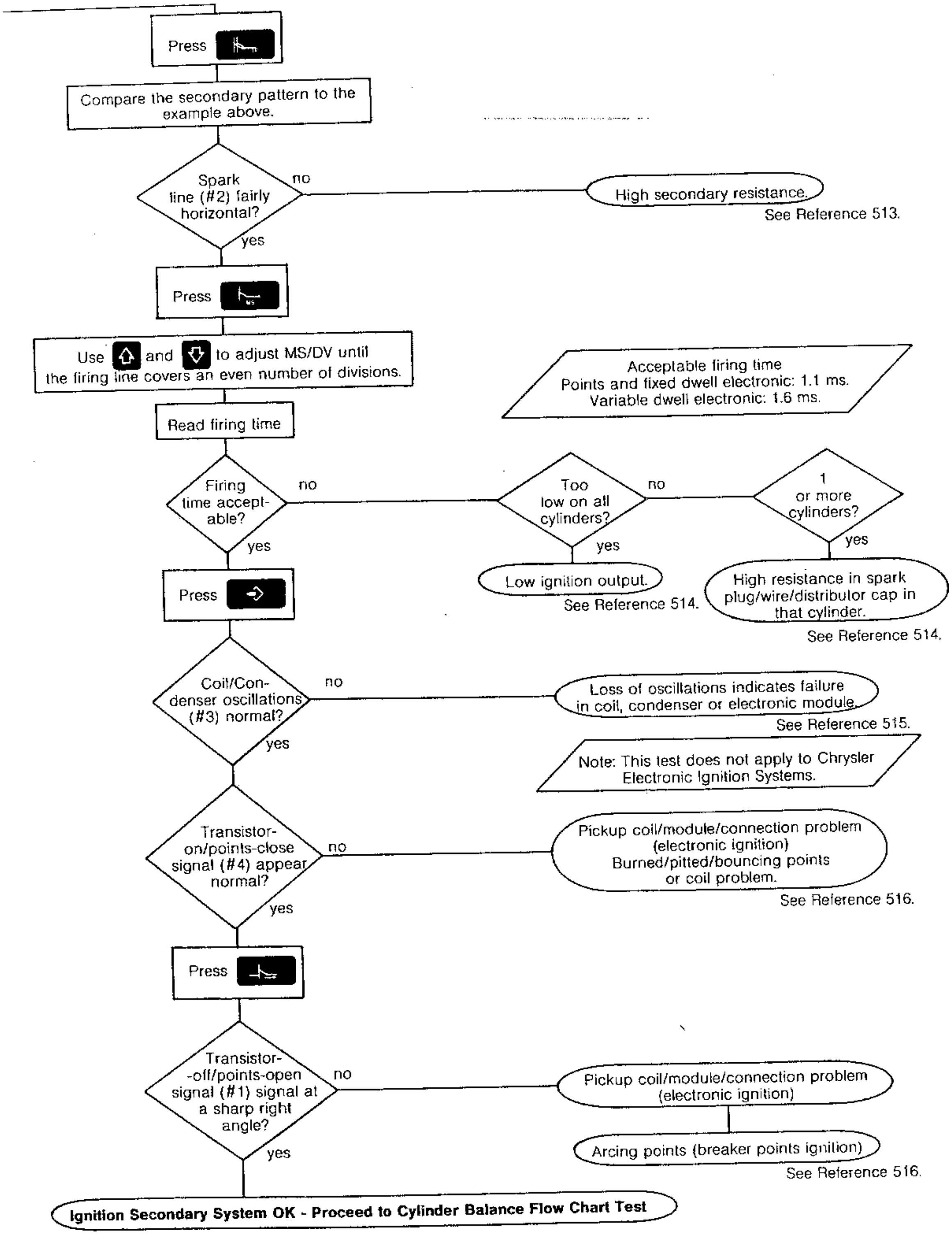
TIMING (MAG TIMING)


Press
MAG TIMING
Prepare for initial timing per the manufacturer's recommendation. See the underhood emission label.
Enter the magnetic timing probe offset.
Set engine at specified initial timing RPM.
Press 10 when testing Chrysler.
Press 11 when testing GM and AMC.
Press 12 for International (ISO).
Timing within specifications?
no
Adjust and proceed with testing.
yes
Restore any connections or disconnections made for initial timing.
Engine equipped with electronic timing advance?
no
Disconnect and plug vacuum advance hose.
yes
Increase engine speed to 2500 RPM.
Centrifugal advance within specification?
no
Raise RPM to:
3000 RPM (8 cyl.)
3400 RPM (4 and 6 cyl.)
yes
Increase engine speed over 2500 RPM.
Centrifugal advance OK
no
yes
Maintain 2500 RPM and reconnect vacuum advance hose.
Possible bad centrifugal advance
See Reference 412.
Total advance within specification?
no
Defective vacuum advance
See Reference 413.
yes
Advance within specification?
no
Defective timing advance or timing advance is inhibited.
See Reference 411.
yes
Timing System OK - Proceed to Ignition Secondary Flow Chart

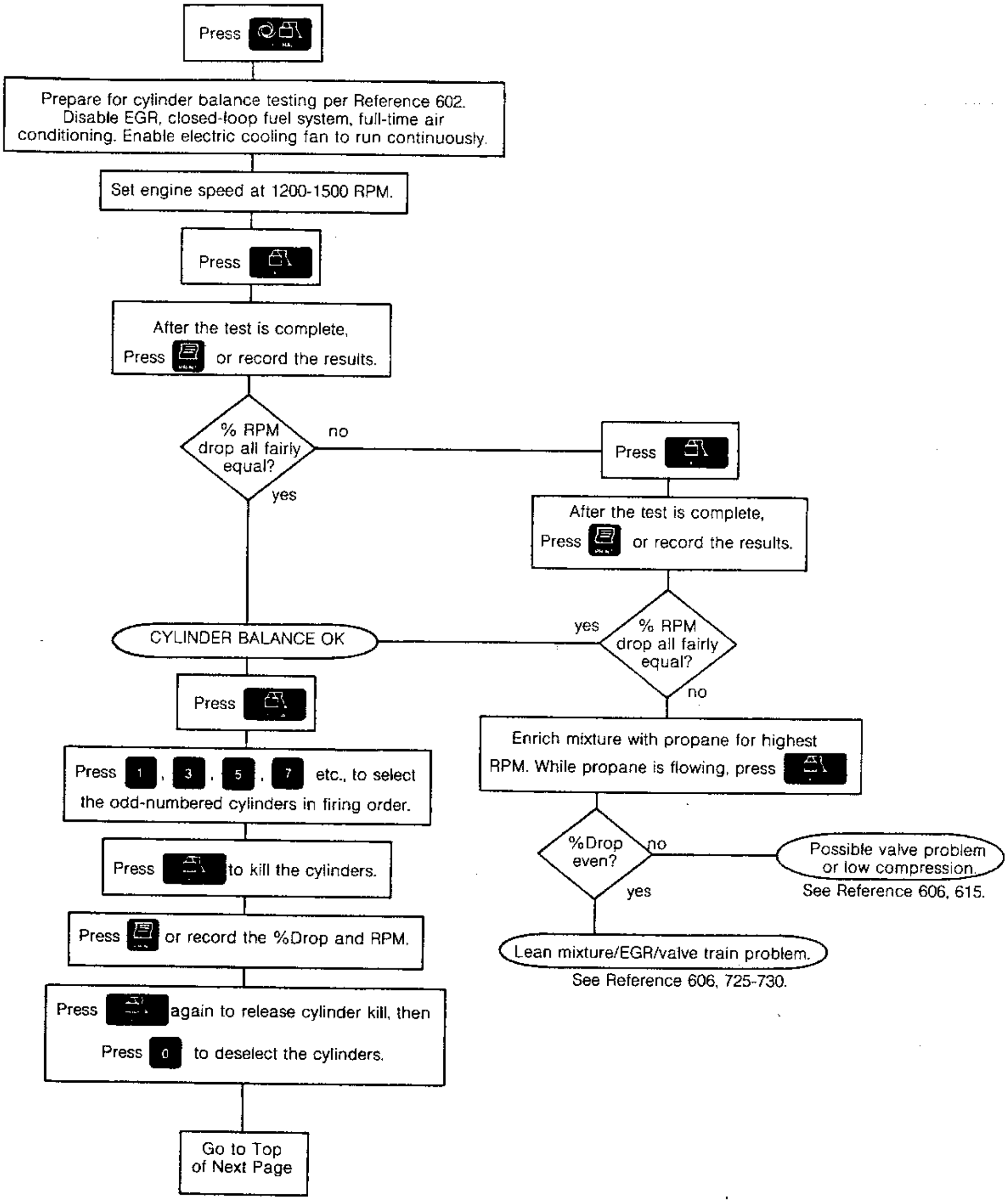
IGNITION SECONDARY SYSTEM


SECONDARY PATTERN
1 Plug Firing Voltage
2 Plug Firing Time
3 Coil/Condenser Oscillations
4 Coil Build-Up
5 Dwell
Press 25 kV
Warm the engine to operating temperature.
Increase RPM to 2300.
Pattern right side up?
no
Reversed coil polarity. Correct and proceed with flow chart.
See Reference 510.
yes
Press
Maintain 2300+ RPM
Average kV below 15?
no
Excessive ignition demand. Possible air leak/lean mixture/bad coil wire/cap/rotor.
See Reference 511.
yes
Press 1, 2, 3, 4, etc. and observe kV.
Individual cylinder kV within 20% of one another?
no
Possible air leak/secondary problem/uneven fuel distribution.
See Reference 511.
yes
Press 25 kV
Allow engine to idle.
Snap throttle open and watch kV peaks for maximum height
Excessive kV differences or peak voltage exceeds 75% of available output?
no
Excessive demand on acceleration.
See Reference 512.
yes
Set engine speed above 2300 RPM
Go to Top of Next Page

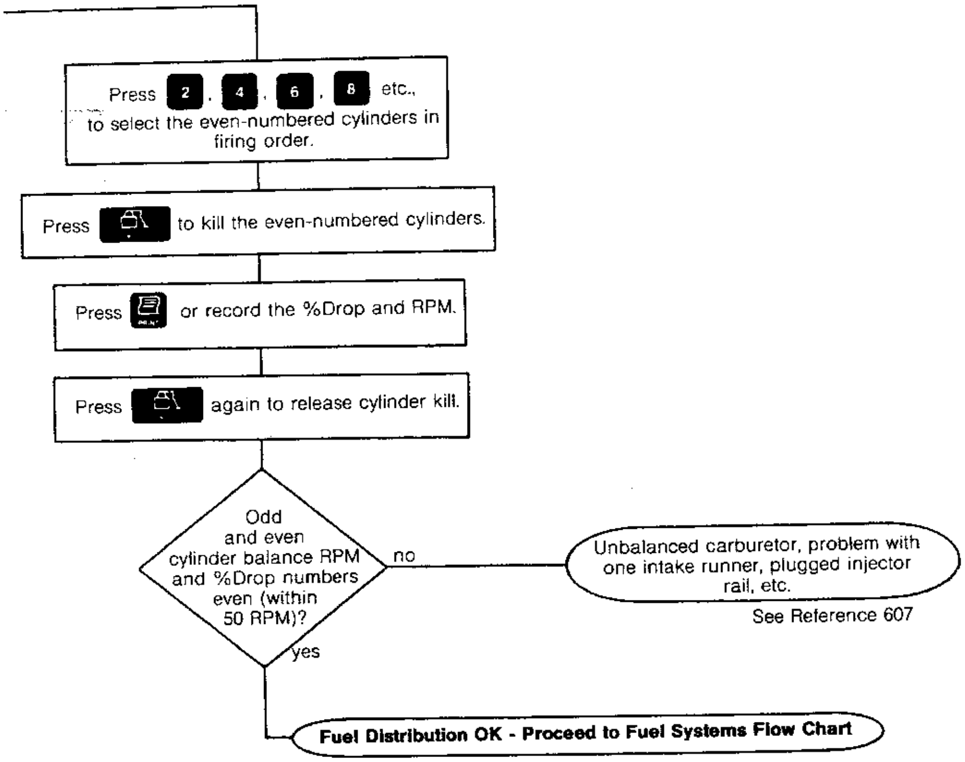
IGNITION SECONDARY SYSTEM


Press
Compare the secondary pattern to the example above.
Spark line (#2) fairly horizontal?
no
High secondary resistance.
See Reference 513.
yes
Press
Use and to adjust MS/DV until the firing line covers an even number of divisions.
Acceptable firing time
Points and fixed dwell electronic: 1.1 ms.
Variable dwell electronic: 1.6 ms.
Read firing time
Firing time acceptable?
no
Too low on all cylinders?
no
1 or more cylinders?
yes
yes
Low ignition output.
See Reference 514.
High resistance in spark plug/wire/distributor cap in that cylinder.
See Reference 514.
Press
Coil/Condenser oscillations (#3) normal?
no
Loss of oscillations indicates failure in coil, condenser or electronic module.
See Reference 515.
yes
Note: This test does not apply to Chrysler Electronic Ignition Systems.
Transistor-on/points-close signal (#4) appear normal?
no
Pickup coil/module/connection problem (electronic ignition)
Burned/pitted/bouncing points or coil problem.
See Reference 516.
yes
Press
Transistor-off/points-open signal (#1) signal at a sharp right angle?
no
Pickup coil/module/connection problem (electronic ignition)
Arcing points (breaker points ignition)
See Reference 516.
yes
Ignition Secondary System OK - Proceed to Cylinder Balance Flow Chart Test

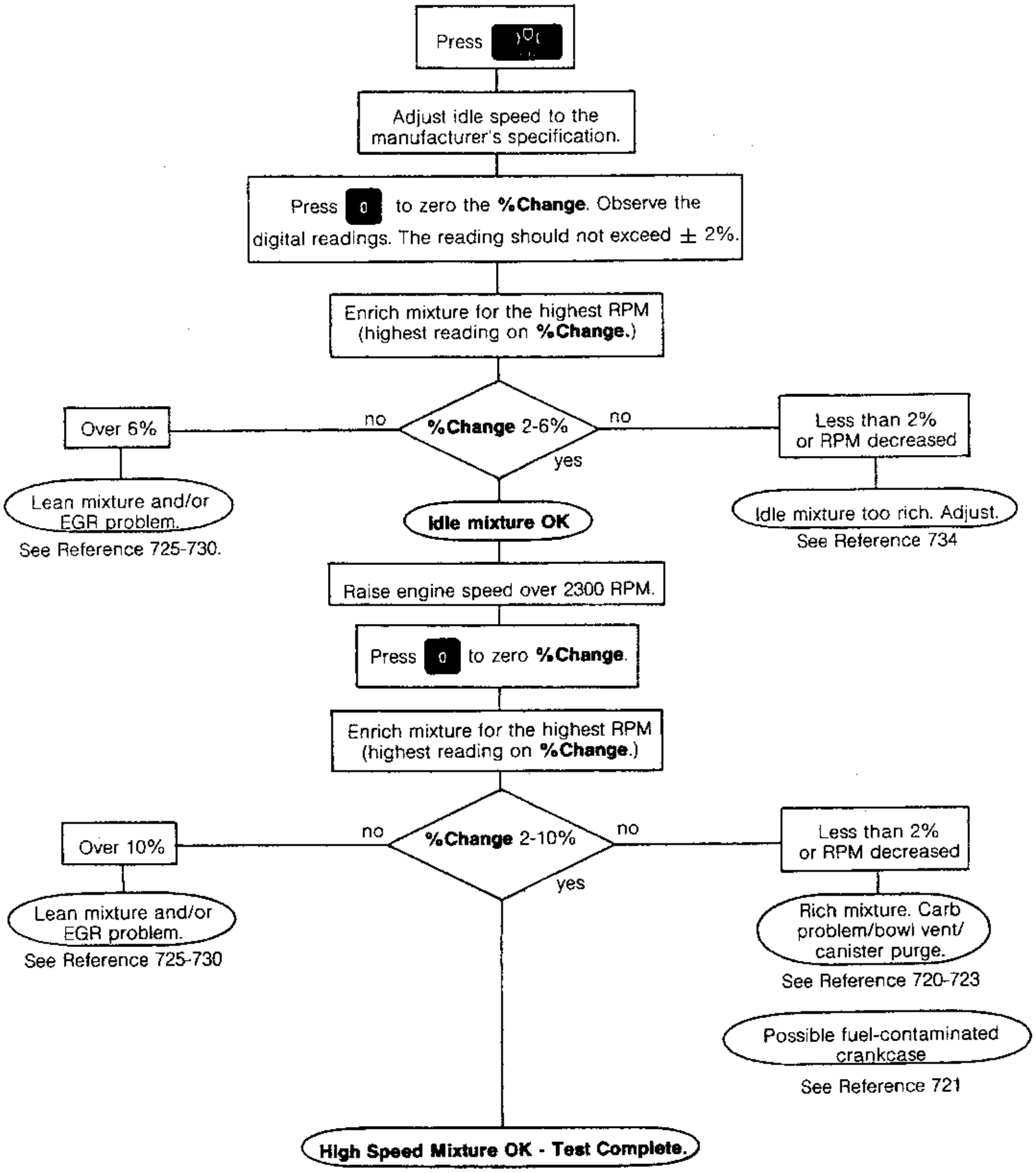
CYLINDER BALANCE


Press
Prepare for cylinder balance testing per Reference 602. Disable EGR, closed-loop fuel system, full-time air conditioning. Enable electric cooling fan to run continuously.
Set engine speed at 1200-1500 RPM.
Press
After the test is complete, Press or record the results.
% RPM drop all fairly equal?
no
yes
Press
After the test is complete, Press or record the results.
CYLINDER BALANCE OK
yes
% RPM drop all fairly equal?
no
Press
Enrich mixture with propane for highest RPM. While propane is flowing, press
Press 1, 3, 5, 7 etc., to select the odd-numbered cylinders in firing order.
%Drop even?
no
Possible valve problem or low compression.
See Reference 606, 615.
yes
Press to kill the cylinders.
Press or record the %Drop and RPM.
Lean mixture/EGR/valve train problem.
See Reference 606, 725-730.
Press again to release cylinder kill, then
Press 0 to deselect the cylinders.
Go to Top of Next Page

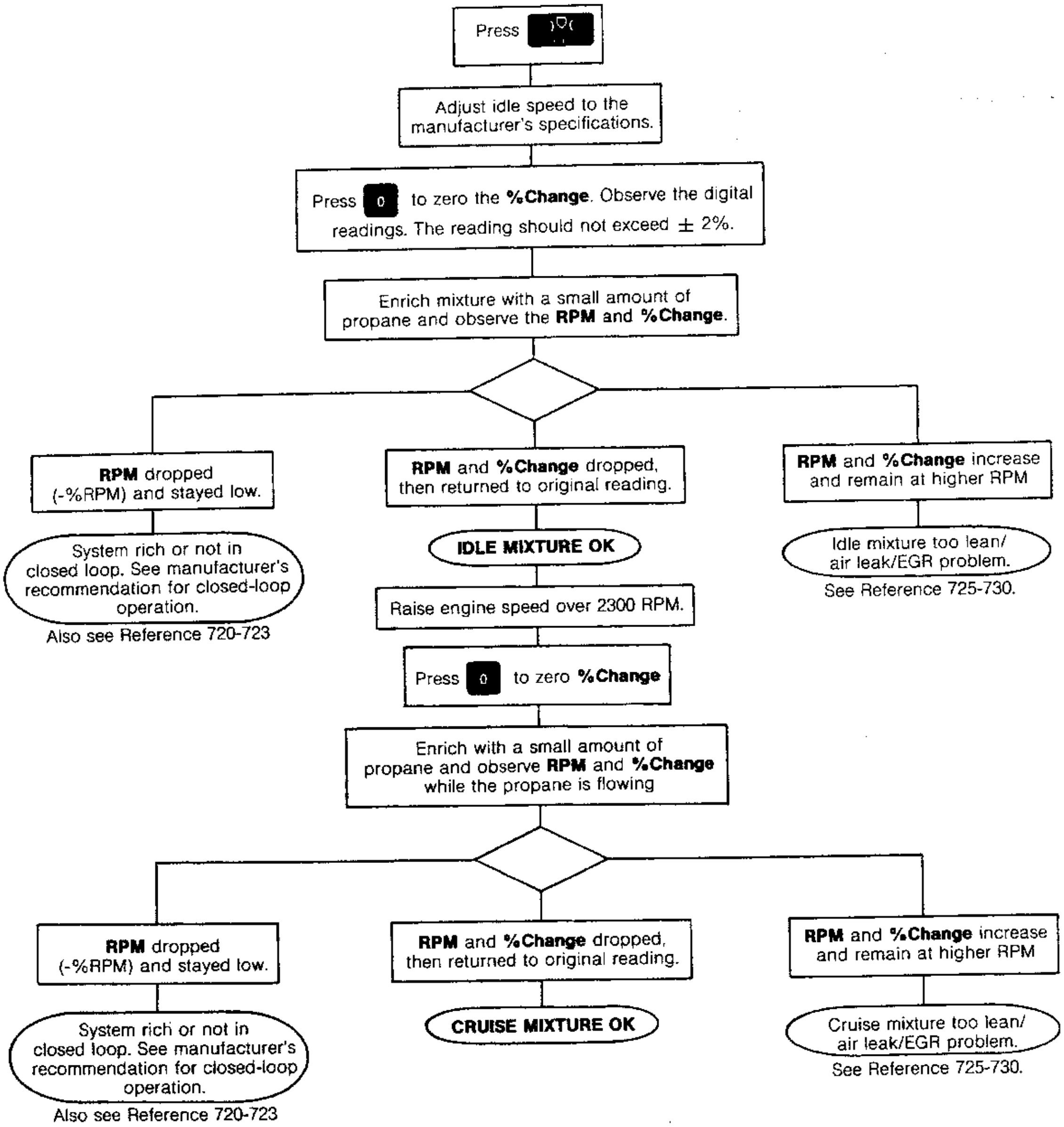
CYLINDER BALANCE


Press 2, 4, 6, 8 etc., to select the even-numbered cylinders in firing order.
Press to kill the even-numbered cylinders.
Press or record the %Drop and RPM.
Press again to release cylinder kill.
Odd and even cylinder balance RPM and %Drop numbers even (within 50 RPM)?
no
Unbalanced carburetor, problem with one intake runner, plugged injector rail, etc.
See Reference 607
yes
Fuel Distribution OK - Proceed to Fuel Systems Flow Chart

STANDARD FUEL SYSTEM (WITHOUT EMISSIONS ANALYSIS)


Press
Adjust idle speed to the manufacturer's specification.
Press 0 to zero the **%Change**. Observe the digital readings. The reading should not exceed ± 2%.
Enrich mixture for the highest RPM (highest reading on **%Change.**)
%Change 2-6%
no
no
yes
Over 6%
Lean mixture and/or EGR problem.
See Reference 725-730.
Idle mixture OK
Less than 2% or RPM decreased
Idle mixture too rich. Adjust.
See Reference 734
Raise engine speed over 2300 RPM.
Press 0 to zero **%Change**.
Enrich mixture for the highest RPM (highest reading on **%Change.**)
%Change 2-10%
no
no
yes
Over 10%
Lean mixture and/or EGR problem.
See Reference 725-730
Less than 2% or RPM decreased
Rich mixture. Carb problem/bowl vent/ canister purge.
See Reference 720-723
Possible fuel-contaminated crankcase
See Reference 721
High Speed Mixture OK - Test Complete.

CLOSED-LOOP FUEL SYSTEM (WITHOUT EMISSIONS ANALYSIS)



Press

Adjust idle speed to the manufacturer's specifications.

Press 0 to zero the **%Change**. Observe the digital readings. The reading should not exceed ± 2%.

Enrich mixture with a small amount of propane and observe the **RPM** and **%Change**.

RPM dropped (-%RPM) and stayed low.

System rich or not in closed loop. See manufacturer's recommendation for closed-loop operation.

Also see Reference 720-723

RPM and **%Change** dropped, then returned to original reading.

IDLE MIXTURE OK

RPM and **%Change** increase and remain at higher RPM

Idle mixture too lean/ air leak/EGR problem.

See Reference 725-730.

Raise engine speed over 2300 RPM.

Press 0 to zero **%Change**

Enrich with a small amount of propane and observe **RPM** and **%Change** while the propane is flowing

RPM dropped (-%RPM) and stayed low.

System rich or not in closed loop. See manufacturer's recommendation for closed-loop operation.

Also see Reference 720-723

RPM and **%Change** dropped, then returned to original reading.

CRUISE MIXTURE OK

RPM and **%Change** increase and remain at higher RPM

Cruise mixture too lean/ air leak/EGR problem.

See Reference 725-730.

TESTING COMPLETE

FUEL SOLENOID SYSTEM

Some manufacturers give specifications in dwell or duty. The table below shows the relationship of the dwell (duty) command from the vehicle's computer.

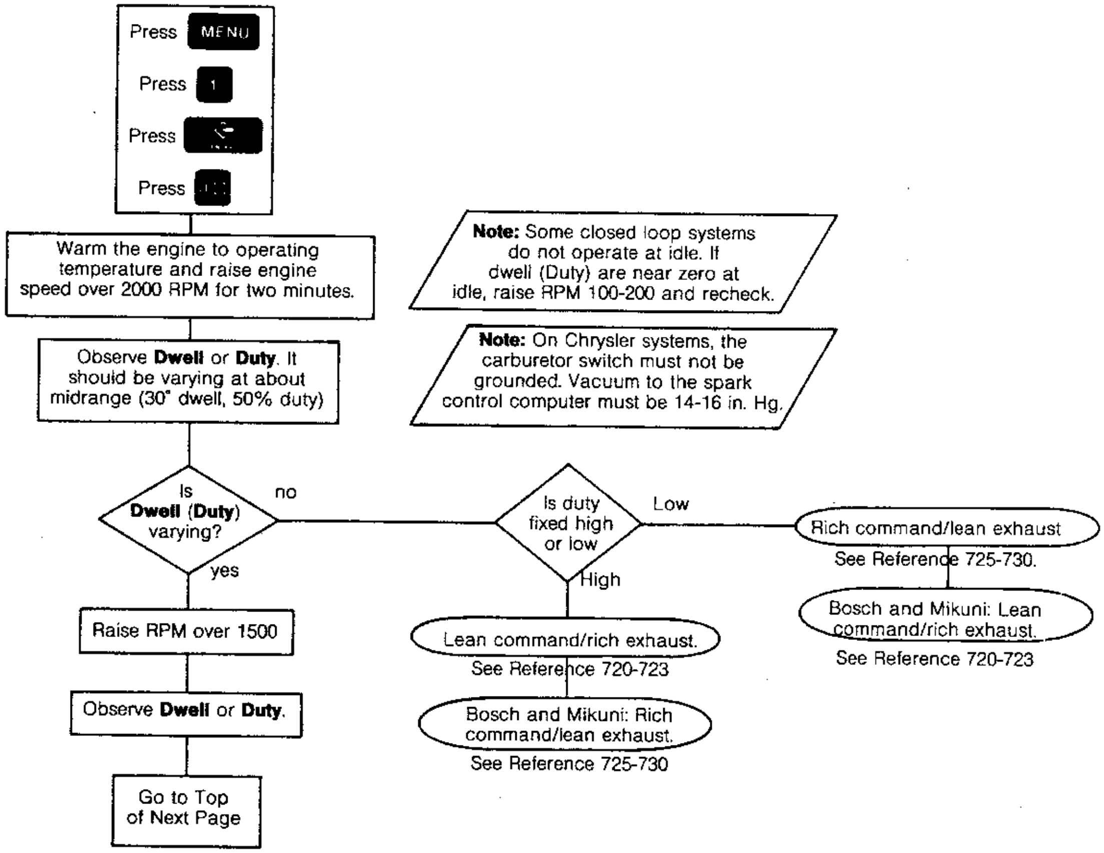
Top scale indicates many fuel systems **increase** the duty to make the mixture leaner.

Middle scale compares duty to the dwell so you can convert one unit to the other.

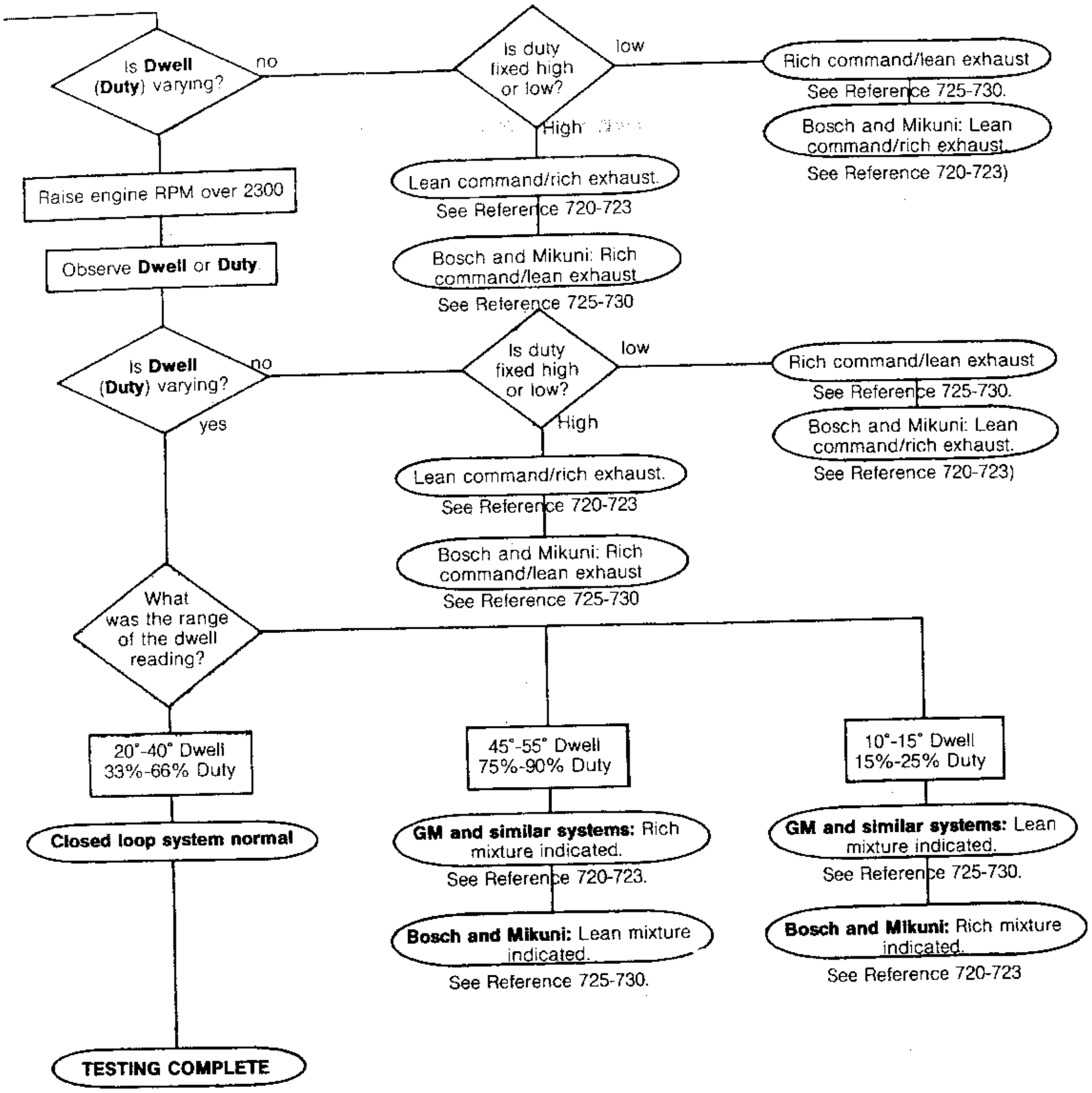
Bottom Scale indicates Bosch CIS and Mikuni **decrease** the dwell to make the mixture leaner.

Connect the **Digital Engine Analyzer** blue lead to the mixture control solenoid. See Reference 711.

					RICH		14.7:1 AFR			LEAN				
DWELL 6-CYL.	0	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	GM, CHRYSLER (except 2.6L), some AMC & some FORD engines with Duty Cycle Mixture Control Solenoids.
%DUTY CYCLE	0%			25%			50%			75%			100%	
DWELL 6-CYL.	0°	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	CIS (K-JET) w/LAMBDA (02) Sensor MIKUNI CARBURETORS w/JET MIX. SOLENOID
					LEAN		14.7:1 AFR			RICH				


Press MENU
Press 1
Press
Press
Warm the engine to operating temperature and raise engine speed over 2000 RPM for two minutes.
Observe **Dwell** or **Duty**. It should be varying at about midrange (30° dwell, 50% duty)
Note: Some closed loop systems do not operate at idle. If dwell (Duty) are near zero at idle, raise RPM 100-200 and recheck.
Note: On Chrysler systems, the carburetor switch must not be grounded. Vacuum to the spark control computer must be 14-16 in. Hg.
Is **Dwell** (**Duty**) varying?
no
yes
Raise RPM over 1500
Observe **Dwell** or **Duty**.
Go to Top of Next Page
Is duty fixed high or low
Low
High
Rich command/lean exhaust
See Reference 725-730.
Bosch and Mikuni: Lean command/rich exhaust.
See Reference 720-723
Lean command/rich exhaust.
See Reference 720-723
Bosch and Mikuni: Rich command/lean exhaust.
See Reference 725-730

FUEL SOLENOID SYSTEM

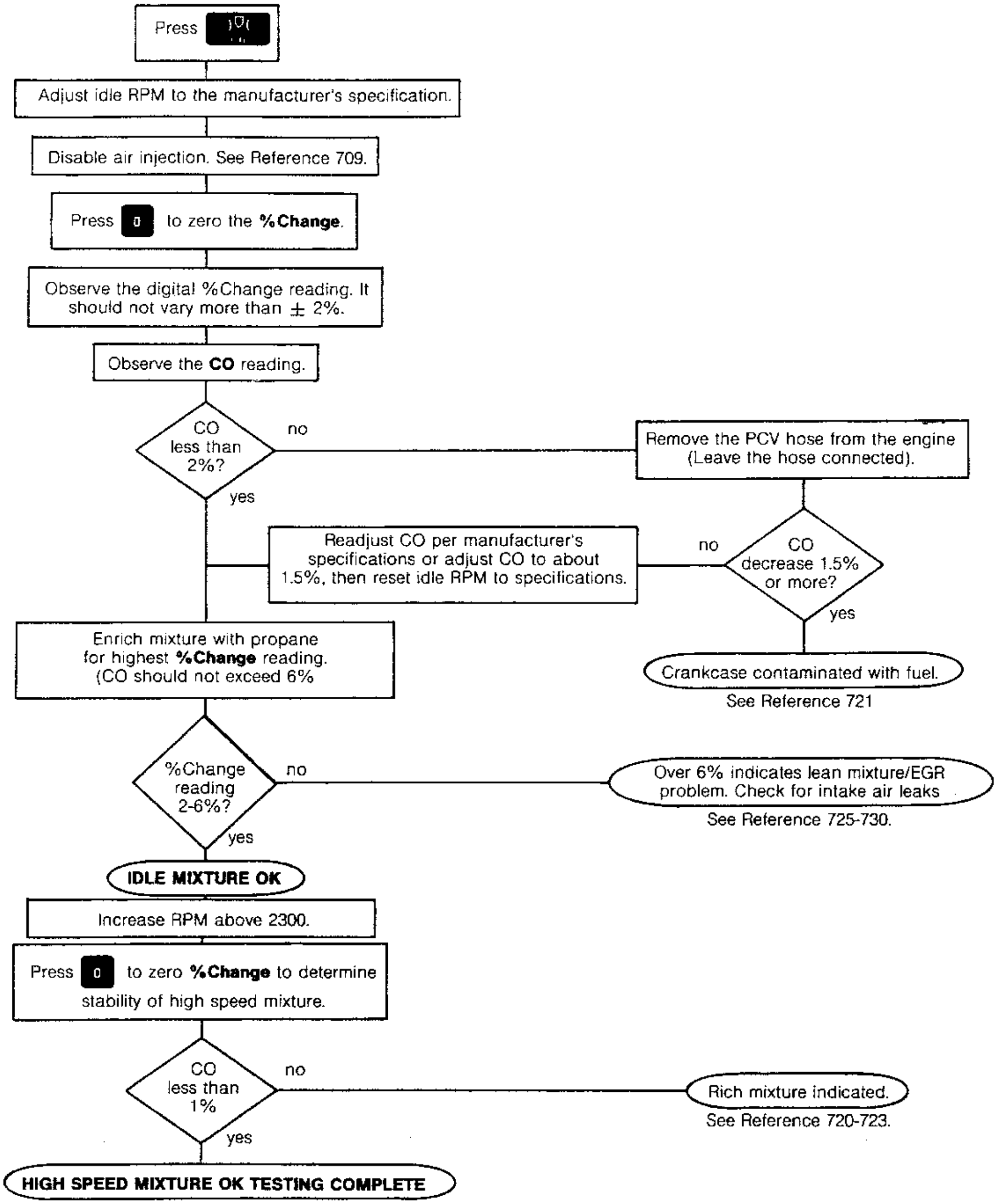


Is **Dwell** (**Duty**) varying?
no
Is duty fixed high or low?
low
Rich command/lean exhaust
See Reference 725-730.
Bosch and Mikuni: Lean command/rich exhaust
See Reference 720-723)
High
Lean command/rich exhaust.
See Reference 720-723
Bosch and Mikuni: Rich command/lean exhaust
See Reference 725-730
Raise engine RPM over 2300
Observe **Dwell** or **Duty**
Is **Dwell** (**Duty**) varying?
no
Is duty fixed high or low?
low
Rich command/lean exhaust
See Reference 725-730.
Bosch and Mikuni: Lean command/rich exhaust.
See Reference 720-723)
High
Lean command/rich exhaust.
See Reference 720-723
Bosch and Mikuni: Rich command/lean exhaust
See Reference 725-730
yes
What was the range of the dwell reading?
20°-40° Dwell 33%-66% Duty
Closed loop system normal
45°-55° Dwell 75%-90% Duty
GM and similar systems: Rich mixture indicated.
See Reference 720-723.
Bosch and Mikuni: Lean mixture indicated.
See Reference 725-730.
10°-15° Dwell 15%-25% Duty
GM and similar systems: Lean mixture indicated.
See Reference 725-730.
Bosch and Mikuni: Rich mixture indicated.
See Reference 720-723
TESTING COMPLETE

FUEL SYSTEM–DEA WITH CO ANALYZER

This test determines whether the fuel system is operating correctly at curb idle, low speed, and cruise modes. This should be the last you perform, after Ignition Primary, Ignition Secondary, and Cylinder Balance have been performed.

To follow this flow chart, your **DEA** must be equipped with the optional carbon monoxide (CO) analyzer.


Press
Adjust idle RPM to the manufacturer's specification.
Disable air injection. See Reference 709.
Press 0 to zero the %Change.
Observe the digital %Change reading. It should not vary more than ± 2%.
Observe the CO reading.
CO less than 2%?
no
yes
Remove the PCV hose from the engine (Leave the hose connected).
Readjust CO per manufacturer's specifications or adjust CO to about 1.5%, then reset idle RPM to specifications.
no
CO decrease 1.5% or more?
yes
Crankcase contaminated with fuel.
See Reference 721
Enrich mixture with propane for highest %Change reading. (CO should not exceed 6%
%Change reading 2-6%?
no
yes
Over 6% indicates lean mixture/EGR problem. Check for intake air leaks
See Reference 725-730.
IDLE MIXTURE OK
Increase RPM above 2300.
Press 0 to zero %Change to determine stability of high speed mixture.
CO less than 1%
no
yes
Rich mixture indicated.
See Reference 720-723.
HIGH SPEED MIXTURE OK TESTING COMPLETE

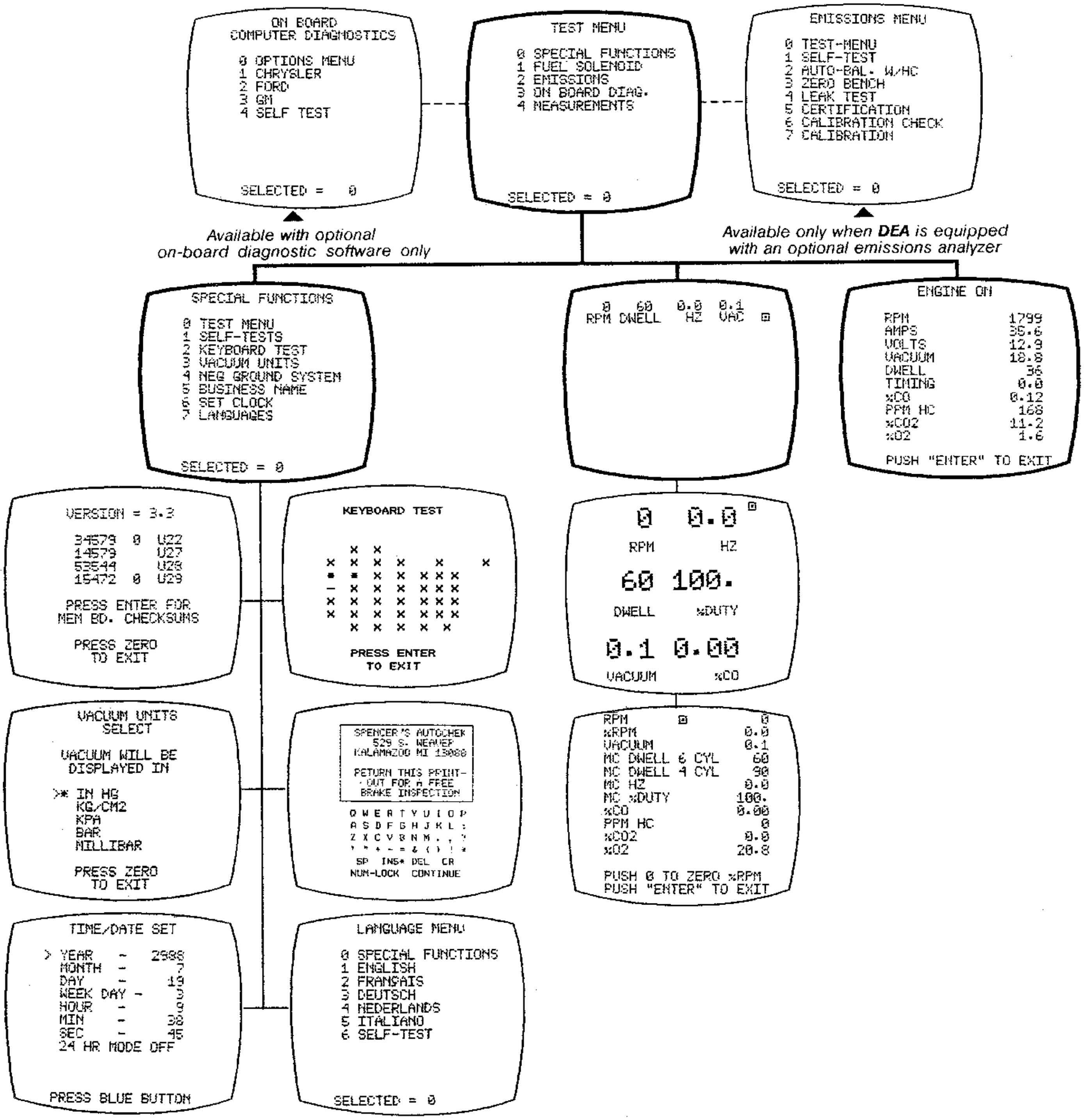
SPECIAL FUNCTIONS

Press the **MENU** key to set up or test your **DEA**.

SPECIAL FUNCTIONS calls up the **Special Functions** screen.

FUEL SOLENOID calls up the **Fuel Solenoid** screen, which displays Mixture Solenoid data and patterns. You can access three different screens, each displaying different data, using the **ALTERNATE SCREEN** key. See section 700 of the **DEA** Programmed Training Course (P/N 25762) for more information.

MEASUREMENTS Calls up the **Measurements** screen which simultaneously displays essential data from several underhood systems.



Available with optional on-board diagnostic software only

*Available only when **DEA** is equipped with an optional emissions analyzer*

```
0    60     0.0   0.1
RPM  DWELL   HZ   VAC   ⊡
```

```
                ENGINE ON

RPM                      1799
AMPS                     35.6
VOLTS                    12.9
VACUUM                   18.8
DWELL                      36
TIMING                    0.0
%CO                      0.12
PPM HC                    168
%CO2                     11.2
%O2                       1.6

PUSH "ENTER" TO EXIT
```

```
VERSION = 3.3

34579  0  U22
14579     U27
53544     U28
15472  0  U29

PRESS ENTER FOR
MEM BD. CHECKSUMS

PRESS ZERO
TO EXIT
```

```
  0      0.0 ⊡
 RPM      HZ

 60     100.
DWELL   %DUTY

0.1     0.00
VACUUM   %CO
```

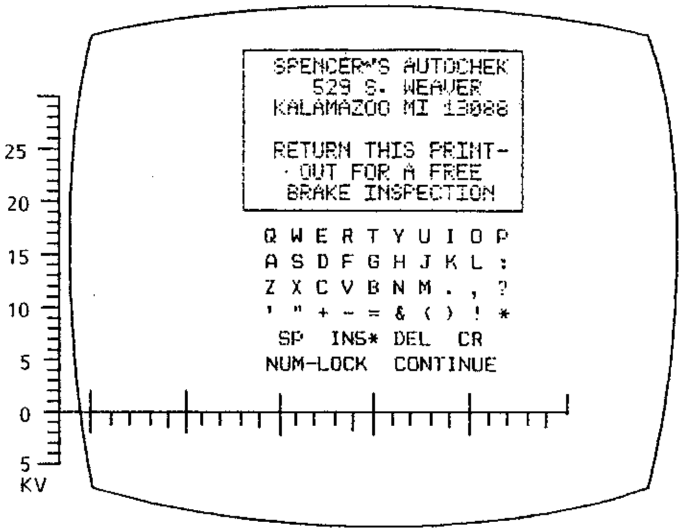
```
VACUUM UNITS
SELECT

VACUUM WILL BE
DISPLAYED IN

>* IN HG
   KG/CM2
   KPA
   BAR
   MILLIBAR

PRESS ZERO
TO EXIT
```

```
SPENCER'S AUTOCHEK
 529 S. WEAVER
KALAMAZOO MI 13088

RETURN THIS PRINT-
-OUT FOR A FREE
BRAKE INSPECTION

Q W E R T Y U I O P
A S D F G H J K L :
Z X C V B N M . , ?
' " + - = & ( ) ! *
SP  INS* DEL  CR
NUM-LOCK  CONTINUE
```

```
RPM        ⊡          0
%RPM                0.0
VACUUM              0.1
MC DWELL 6 CYL       60
MC DWELL 4 CYL       90
MC HZ               0.0
MC %DUTY           100.
%CO                0.00
PPM HC                0
%CO2                0.0
%O2                20.8

PUSH 0 TO ZERO %RPM
PUSH "ENTER" TO EXIT
```

```
TIME/DATE SET

> YEAR     -   2988
  MONTH    -      7
  DAY      -     19
  WEEK DAY -      3
  HOUR     -      9
  MIN      -     38
  SEC      -     45
  24 HR MODE OFF

PRESS BLUE BUTTON
```

APPENDIX A
STATION NAME ENTRY



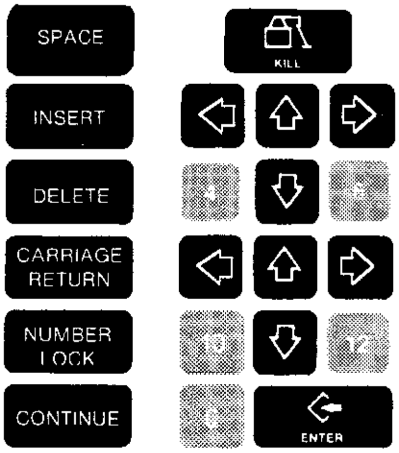
```
SPENCER'S AUTOCHEK
   529 S. WEAVER
KALAMAZOO MI 13088

RETURN THIS PRINT-
 OUT FOR A FREE
 BRAKE INSPECTION

Q W E R T Y U I O P
A S D F G H J K L :
Z X C V B N M . , ?
' " + - = & ( ) ! *
 SP  INS* DEL  CR
NUM-LOCK  CONTINUE
```

Your Station name, address, phone number and advertising message (up to six lines total) can be displayed on any diagnostic printout. It remains stored in the **DEA**'s memory even if the unit is turned off or unplugged. The message can also be modified at any time.

To make the Station Name entry as simple as possible, the function of the Pattern Control keys and the numeric keypad have been reassigned.

Procedure

1. Press the **MENU** key.
2. Press **ENTER** (0, Special Functions is preselected).
3. Select **5 BUSINESS NAME.**
4. Enter the station name using the keypad as indicated (refer to the illustration and instructions below).



The **TOP** arrow keys position the cursor in the box. This is the POSITION cursor.

The **BOTTOM** arrow keys select the letter. This is the LETTER cursor.

5. Position the TOP cursor in the correct position in the box.

6. Position the BOTTOM cursor on the correct letter.
7. Press the **ENTER** key to print that letter on the screen.

Enter prints the letter selected by the cursor.

Test Selection Keys

Functions for these keys remain unchanged–they are still active during Station Name Entry.

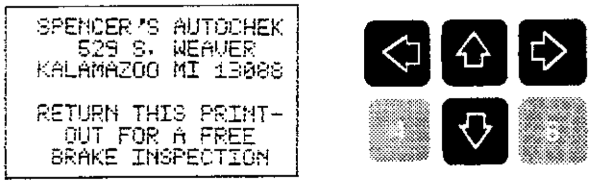
Pattern Keys

These keys now represent word processing commands for station name entry. Their functions are listed at the bottom of the screen. They are active when marked with an asterisk (**Insert** is marked in the illustration below).

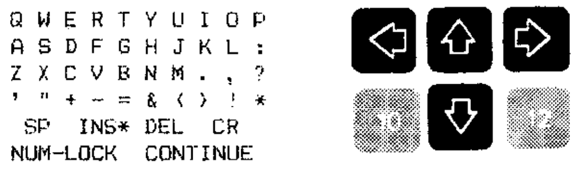
Space	inserts a space between words.
Insert	allows new characters to either <u>replace</u> (Insert OFF) a letter or space or to print the letter and move the rest of the characters to the right. **Note**: if a word reaches the end of a line, individual letters automatically advance to the next line.
Delete	removes the letter under the cursor in the box.
Carriage Return	advances the cursor to the beginning of the next line. This is different from the POSITION cursor.
Number Lock	allows you to print numbers using the number keypad (1-12).
Continue	ends the session, saves the screen in memory and returns to the diagnostic inspection screen.

Numeric Keypad

Kill	erases the entire contents of the box.
1, 2, 3, 5	Left, Up, Right, and Down movement (respectively) of the POSITION cursor in the box. The cursor indicates the location the next letter will print.
7, 8, 9, 11	position the LETTER cursor over the "Keyboard." The cursor indicates which letter will be printed.



```
SPENCER'S AUTOCHEK
  529 S. WEAVER
KALAMAZOO MI 13088

RETURN THIS PRINT-
 OUT FOR A FREE
 BRAKE INSPECTION
```



```
Q W E R T Y U I O P
A S D F G H J K L :
Z X C V B N M . , ?
' " + - = & ( ) ! *
 SP  INS* DEL  CR
NUM-LOCK  CONTINUE
```

Enter	prints the letter selected by the cursor.

Entering Time and Date

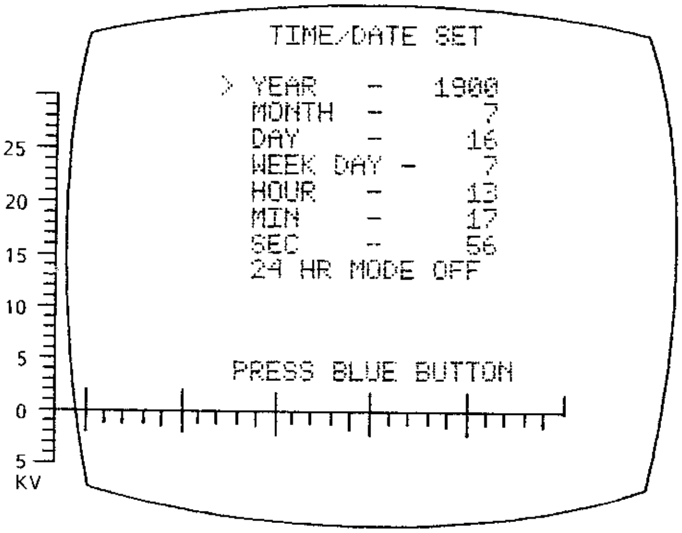
Print prints the station name as it will appear on the printout.

Centering Your Message

Enter each line of text without attempting to center. When you're through, Move the POSITION cursor to the beginning of each line, press **INSERT**, then **SPACE**. Add enough spaces to center the text on the line.

ENTERING TIME AND DATE

The time and date is printed each time the **Visual Inspection** or **Station Name** is printed.



```
TIME/DATE SET

> YEAR      -    1900
  MONTH     -       7
  DAY       -      16
  WEEK DAY  -       7
  HOUR      -      13
  MIN       -      17
  SEC       -      56
  24 HR MODE OFF

PRESS BLUE BUTTON
```

Test Procedure

1. Press the **MENU** key.
2. Select **Special Functions**.
3. Select **SET CLOCK**
4. Use the Up/Down Arrows to position the pointer next to the correct item.
5. Adjust each item using the NUMBER keys (1 through 9 and 0).

Note: if you enter an invalid number (such as Month = 36), the **DEA** will automatically switch to the closest valid number (Month = 12).

6. To select the correct day:
   1 = Sunday
   2 = Monday
   3 = Tuesday
   4 = Wednesday
   5 = Thursday
   6 = Friday
   7 = Saturday

7. When *all* the information is correct press any Blue key. This records the time/date information in memory. The **DEA** retains this information memory even if the unit is turned off or unplugged.

24 Hour Mode on/off allows you to switch between the 12-hour clock (1 p.m.) to the 24 hour clock (13:00). Use the Up/Down arrow keys to select **24 Hour Mode**, then press **ENTER**.

Memory Board Checksums display the internal identification numbers of the memory chips used in programming the **DEA**. This information is useful to Allen Service only.

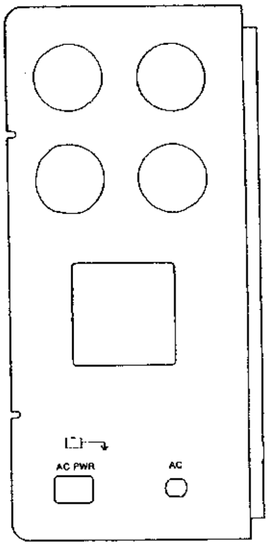
APPENDIX B
Maintenance

Rear Panel and Circuit Breakers, Air Filter, Front Panel, Cabinet, Banner, Current Probe

APPENDIX B
MAINTENANCE

REAR PANEL CONNECTIONS AND CIRCUIT BREAKERS

(**Note:** Press the RESET button if the circuit breaker pops. If it continues to pop repeatedly, call Allen Service.)

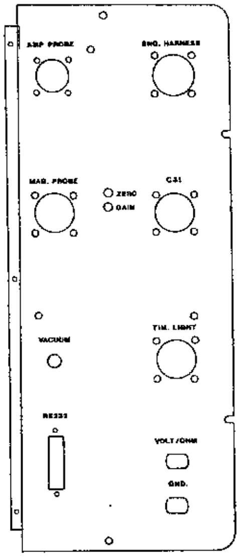


LEFT PANEL

Gnd. - **Digital Engine Analyzer** chassis ground. Used by Allen service personnel to prevent static damage to the circuit boards.

AC PWR - main power circuit breaker (10 amp). If this breaker trips, the **Digital Engine Analyzer** will not operate.

AC - connector for the main power cord.



RIGHT PANEL

Amp Probe - connector for the engine harness Amp Probe.

Mag. Probe - connector for the magnetic timing probe.

Vacuum - brass vacuum hose connector. This is connected to an electronic vacuum transducer.

RS232 - computer port for future expansion.

Engine Harness - connector for the engine harness lead set.

Zero - zero for the vacuum reading. See next page for vacuum zeroing procedure.

Gain - adjustment for Allen service personnel only.

C3I - connector for the Allen Distributorless Ignition Adapter used for testing General Motors Computer Controlled Coil Ignition (C3I) systems.

Tim. Light - electrical connector for the timing light.

Volt/Ohm - circuit breaker (2 amp). May open if the ohm meter probes are connected to a "live" (voltage carrying) circuit.

Gnd - circuit breaker (6 amp). Protects the vehicle and AC ground. If the **GND** circuit breaker trips, cylinder kill function will not operate.

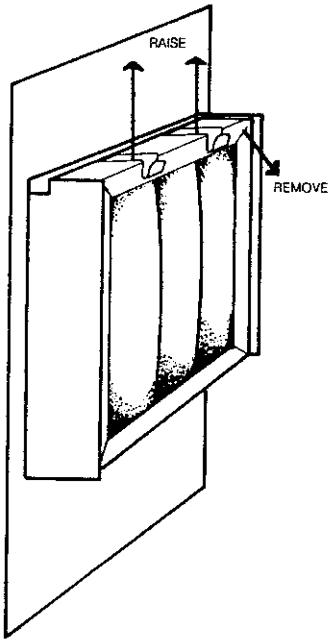
Miscellaneous Maintenance, Changing Printer Paper

AIR FILTER

Clean this filter weekly.

DEA, DEA with CO Module or DEA with 4-Gas Module

1. Raise the two clips at the top of the filter and pull the top forward and up to remove it from the **DEA** rear panel.
2. Follow the cleaning instructions printed on the filter housing.
3. To reinstall, insert the bottom of the filter into the channel, raise the clips at the top and press the top of the filter into place.



DEA 4-Gas Analyzer

1. Slide the air filter to the left.
2. Remove the foam filter from between the grids.
3. Clean with warm soapy water, starting at the top and working down.
4. Air dry and reinstall.

PLEXIGLASS FRONT PANEL

Use a commercial window cleaner mixed 1:1 with water on both sides. **DO NOT** use abrasive cleaners or scouring pads.

CABINET

Clean using a commercial spray cleaner (Formula 409 or a similar product) mixed 1:1 with water.

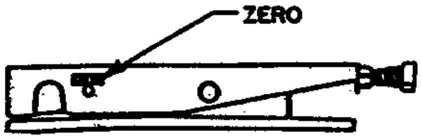
BANNER LIGHT

Unplug the **DEA** and open the front panel to replace a burned out banner light with a 36-inch (91.4cm) fluorescent tube.

CURRENT PROBE

If the amps reading is not zero when the current probe is not connected to a conductor use this procedure:

1. Press the **CRANKING** key.
2. Locate the "Zero" pot on the side of the Current Probe.



P/N 42856

3. Watch the amps reading on the screen and use a small screwdriver to adjust the reading to Zero.

MAGNETIC TIMING PROBE

Lubricate the tip of the magnetic timing probe with a drop of light oil before testing.

SYNC PROBE

Keep the metallic elements inside the probe clean. A buildup of grease or dirt can cause erratic sync readings to the **DEA**.

VACUUM READING

If the vacuum reading is not zero when the hose is disconnected, use the following procedure:

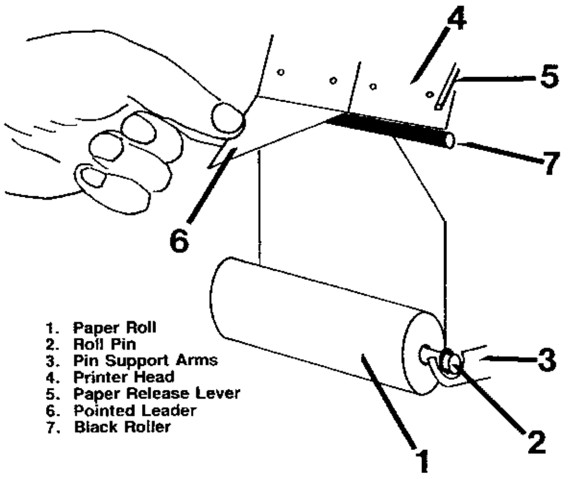
1. Locate the "Zero" pot on the right panel on the back of the **Digital Engine Analyzer**.
2. Press the **FUEL SYSTEM** key.
4. Use a small screwdriver to adjust the vacuum reading to Zero.

CHANGING PRINTER PAPER

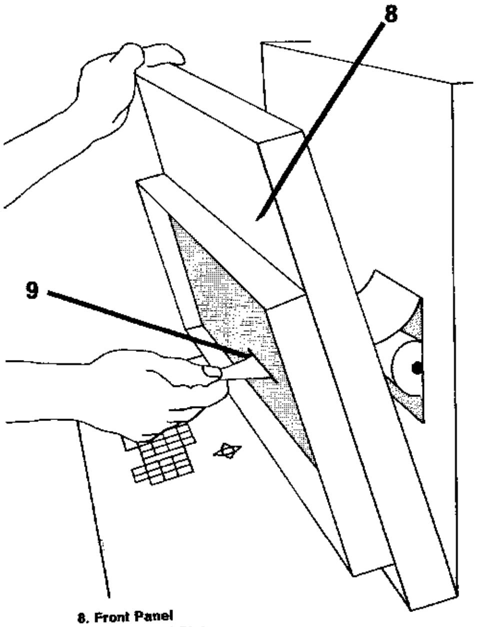
(optional Printer)

Use the following procedure to change the printer paper.

1. Pull the front panel down to open.



1. Paper Roll
2. Roll Pin
3. Pin Support Arms
4. Printer Head
5. Paper Release Lever
6. Pointed Leader
7. Black Roller



8. Front Panel
9. Paper Feed Slot

2. Lift up printer lever (5) to release the paper.
3. Lift the roll, remove the roll pin and pull out any leftover paper.
4. Place the new roll on the pin and install on the support arms. The paper should feed upward from the back of the roll.
5. Fold the leading edge of the new roll as shown. This helps start the new roll into the printer.
6. Insert pointed end of the paper just behind the black roller (4) and push upward until the paper appears under the printer head (6).
7. Carefully pull the point of the paper through the printer about 12 inches, and then press the printer lever down to engage the printer.
8. Feed printer paper through the feed slot (8).
9. Hold on to the printer paper while closing the front panel (9). Once the front panel is fully closed, gently pull on the printer paper to remove any slack.

Optional Gas Analyzer Filter Replacement

GAS ANALYZER FILTER REPLACEMENT

Clean monthly or as required, depending on use.

(**DEA** with Optional **CO** or **4-Gas Module**)

There are two types of filter assemblies: one has a plastic head and the other has a metal head. The type your **DEA** uses depends on the age of the analyzer and the type of optional gas analysis equipment installed.

Filter-change procedures for both the plastic and metal head assemblies are listed below.

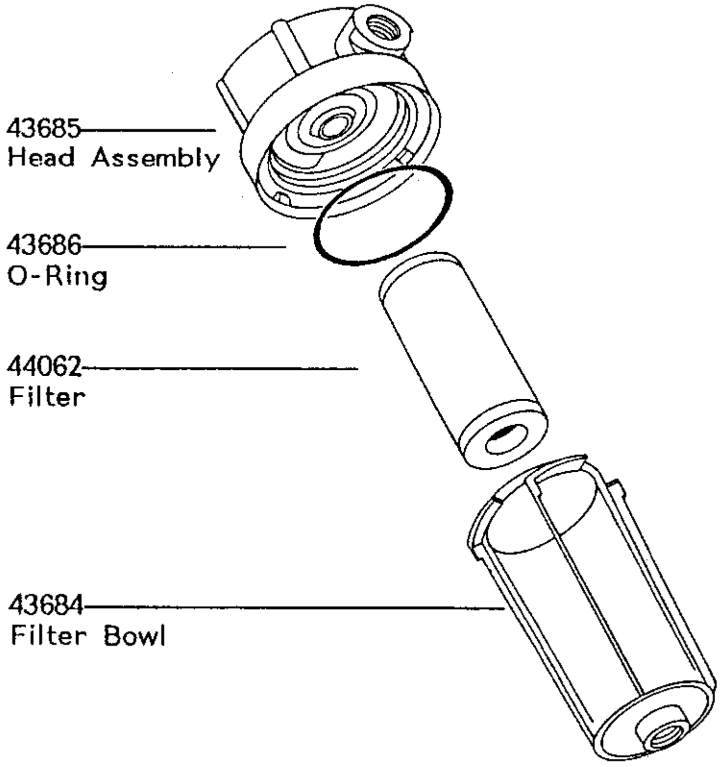
Check the filter element daily and replace when it is dirty of soaked.

Note: Always keep spare filters on hand. A gas analyzer with a low flow condition will not provide accurate readings.

Caution: Never operate a gas analyzer without a filter element.

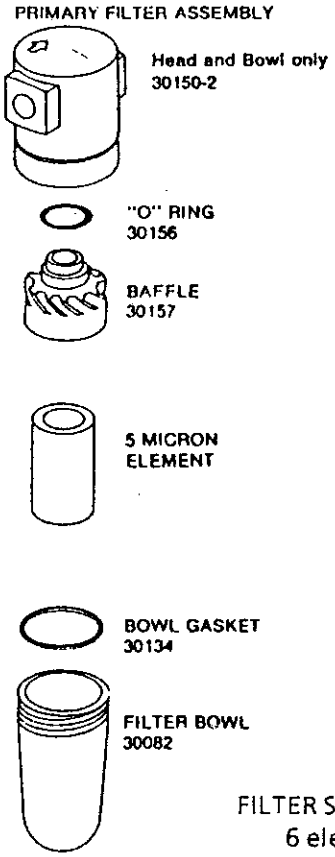
Filter Replacement– Plastic Head Assembly

1. Turn the filter bowl clockwise until is disengages (about 1/8 of a revolution).
2. Replace the filter element and install the orange O-ring (you may have to retrieve it from the head assembly).
3. Reinstall the filter bowl, turning it counterclockwise until it locks into place.



Filter Replacement–Metal Head Assembly

1. Disconnect the drain hose from the bottom of the bowl assembly .
2. Unscrew the filter bowl and remove the old filter.
3. Insert the new filter element.
4. Install the bowl O-ring and screw the bowl unit on to the head assembly. Tighten until snug (about 4 revolutions).



FILTER SERVICE KIT 31584 INCLUDES:
- 6 elements (with seals) 44062
- 3 bowl gaskets 30134
- 1 upper seal 43212
- 1 lower seal 43190

Caution: When replacing the filter, the filter bowl gasket O-ring **must** be in place to prevent leaks and sample dilution.

PART & OPTIONS

DIGITAL ENGINE ANALYZER SERVICE PARTS LIST

Item	**P/N**
Air Filter	43881
Gas Analyzer Filter (metal head assembly)	41966
Gas Analyzer Filter (plastic head assembly)	44062
Engine Harness	43707
Current Probe	43787
Magnetic Timing Probe	41157
Timing Light	43057
Printer Paper	43931

AVAILABLE OPTIONS

Option	**Model Number**
4-Gas Module (BAR 80 certified)	53-710
4-Gas Module (non-certified)	53-720
1-Gas (CO) Analyzer	10-020
Printer	10-030
On-board Diagnostics Update	10-180
International Languages	
French/German/Dutch/Italian	10-040
Spanish/Portuguese/Italian/French	10-050
Danish/Swedish/Finnish/German	10-060
Optional **DEA** Accessory Kit	10-070
Capacitive Discharge Ignition Adapter	32-170
Distributorless Ignition Adapter	32-570
DEA Stand and Boom	60-200
DEA Stand and Boom with Toolbox	60-210

ALLEN GROUP
Testproducts
Division

Kalamazoo, Michigan 49002, U.S.A.; Mississauga, Ontario, Canada L4X 2G1

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